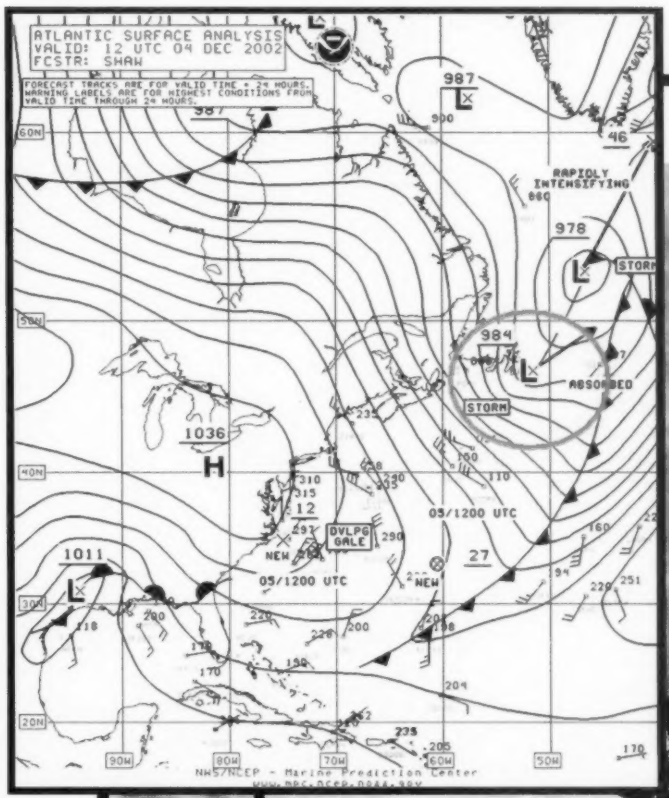
Mariners Weather Log

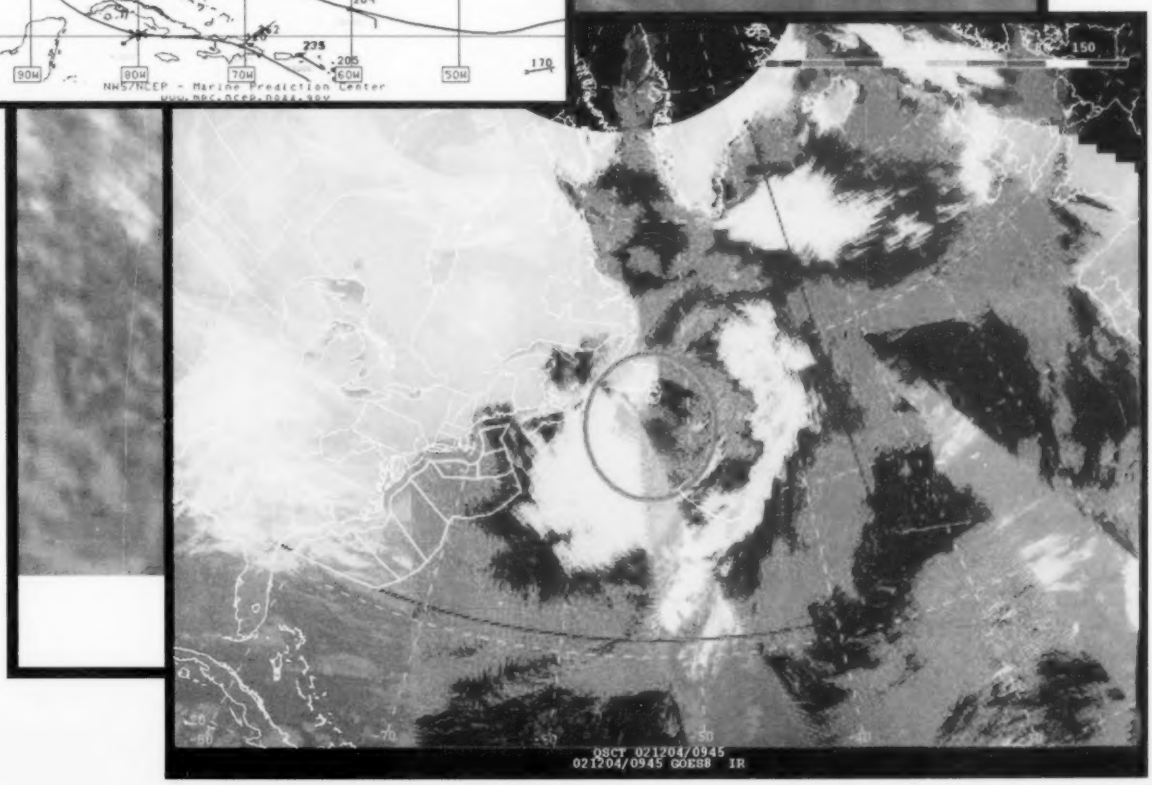
Vol. 47, No. 2 December 2003



QuikSCAT

One of the Newest Tools for Forecasting Severe Weather

See Page 14 and Page 20.



Mariners Weather Log
U.S. Department of Commerce
Donald L. Evans, Secretary

VADM Conrad C. Lautenbacher, Jr. (USN-Ret.)
Under Secretary of Commerce for Oceans and Atmosphere

National Weather Service
Brig. Gen. John J. Kelly, Jr. (USAF-Ret.)
Assistant Administrator for Weather Services

Editorial Supervisor
Robert A. Luke

Layout/Design/Editors
Patti Geistfeld
Stuart Hayes

Articles, Photographs, and Letters should be sent to:

Mr. Robert A. Luke, Editorial Supervisor
Mariners Weather Log
NDBC (W/OPS 52)
Bldg. 3203, Room 305B
Stennis Space Center, MS 39529-6000

Phone: (228) 688-1457 Fax: (228) 668-3923
E-Mail: robert.luke@noaa.gov

From the Editorial Supervisor

Hello, and welcome to the Mariners Weather Log (MWL). This has been an exciting time since we last had time to chat. As I mentioned in the last issue, we are now back to offering three issues per year of the MWL. It was a bit rough getting back into the three issue routine. In the past, as soon as I put one issue to bed, I was right at the next. Going to just two issues offered me a bit of a breather to help my sanity a bit. Of course, just like underway times, when you have too much free time between watches, the Captain always finds a "Special Project" just for you. Oh well, guess that is what they pay me for anyway.

In this issue we have some exciting news, we now have a new PMO office active and on line down in sunny Charleston, SC. Mr. Tim Kenefick, who has been our PMO up in Newark for the past eight years, has finally figured which exit to take off the turnpike and is now down south waiting to support y'all from the old Navy Yard. A replacement PMO is in the process of being hired to keep up Tim's legacy in Newark and beyond. This information and much more can be found in our new "Region News" section. This section is to showcase the efforts of the PMOs, Forecast Offices, and of course, the VOS ships in the six different regions of our VOS program.

Also in this issue is another great article from Jamie Rhome (Tropical Prediction Center) on the use of satellites to assist in forecasting out at sea. We also have a second stellar piece from the Ocean Prediction Center (OPC) on how Scatterometer technology aids in marine wind warnings, and a two for one offering from the International Ice Patrol to get us ready for the upcoming winter season.

Thank you once again for your efforts in our VOS program. You are our windows to the sea and are greatly appreciated even if we do not say it as often as we should. It is my holiday wish that each and every one of you return safely from Neptune's playground and have an enjoyable and memorable holiday season with those you love. Remember that no matter what course you may chart, the only true snug harbor is in the arms of the loved ones left ashore.

Happy Holidays, Luke ⚓

Some Important Web Page Addresses

NOAA	http://www.noaa.gov
National Weather Service	http://www.nws.noaa.gov
National Data Buoy Center	http://www.ndbc.noaa.gov
AMVER Program	http://www.amver.com
VOS Program	http://www.vos.noaa.gov
SEAS Program	http://seas.nos.noaa.gov/seas/
Mariners Weather Log	http://www.nws.noaa.gov/om/mwl/mwl.htm
Marine Dissemination	http://www.nws.noaa.gov/om/marine/home.htm
U.S. Coast Guard Navigation Center	http://www.navcen.uscg.gov/marcomms/

See these Web pages for further links.

Table of Contents

Ice Season 2002, Tabular Icebergs Past and Present 4

Iceberg Population below 48N 8

Detecting Marine Winds from Space: Scatterometry 14

QuikSCAT and the Issuance of Marine Wind Warnings 20

Voyage on the **Robert Seamans** 27

Hurricane Tracking on **Explorer of the Seas** 28

Storm Force Winds Batter the Western Cape 29

Shipwreck: **Transpacific** 30

Obtaining Buoy Reports while at Sea 31

Departments:

Marine Weather Review

North Atlantic March - August 2003 32
North Pacific March - August 2003 42
Tropical Atlantic and Tropical East Pacific - January - June 2003 49
Mean Circulation Charts - March - August 2003 55

VOS Program & Regional News

New Recruits - May 1, 2003 - October 31, 2003 56
Regional News 57
VOS Program Awards 59
VOS Cooperative Ship Reports 70

Meteorological Service Points of Contact 79

Very Large Tabular Icebergs: Ice Season 2002 and the Past

LT Scott A. Stoermer, U.S. Coast Guard
Mr. Pip Rudkin, Provincial Airlines Limited

Introduction

Exceptionally large icebergs, commonly referred to as ice islands, came again into the public eye recently with the breaking loose of a portion the Antarctic ice sheet roughly ten times the size of the island of Manhattan (Dykstra, 2002). The glaciers of the North Atlantic, specifically along the western coast of Greenland, are not as conducive to very large iceberg generation as southern hemisphere ice fields, but do occasionally produce "Antarctic" size icebergs.

Ice Season 2002 (February 17, 2002 through July 15, 2002) saw some of the largest North Atlantic icebergs on recent record. These icebergs were actively tracked for a period of approximately two months during the summer, were photographed, and were even examined with side-scan sonar instruments. This brief report documents this season's sightings and provides some historical data and context forthese phenomena.

Background

The International Ice Patrol has monitored icebergs that drift south along the coast of Labrador and onto the Grand Banks of Newfoundland region since the sinking of the **Titanic** in April of 1912. The Labrador Current carries the icebergs that calve, or break away, from glaciers in Greenland and northern Canada southward from Baffin Bay and Davis Strait. Several glaciers are capable of producing icebergs that end their journey on the Grand Banks. Specifically, the Ward Hunt ice shelf, the Humboldt Glacier, and the Petermann Glacier are likely sources of ice islands as the basin conditions seem to favor the production of large tabular icebergs (Robe, 1977).

As defined by Bowditch, an ice island is a piece of glacial ice that rises roughly 10 meters above the ocean's surface and has an overall thickness of about 50 meters. Often, ice islands will have a wave-like surface, appearing ribbed from the air. The surface area of an ice island can range from a few thousand square meters to hundreds of square nautical miles. Thusly, ice islands are not necessarily huge, in terms of surface area, but are unusually thin and flat-topped.

No matter the source, tracking and monitoring the danger posed by icebergs to transatlantic shipping interests is the responsibility of the International Ice Patrol. The offshore oil and gas industry has a keen interest in typical iceberg drift tracks as well as average iceberg mass and size distribution as more facilities, both fixed and mobile, are being moved onto the Grand Banks. Ice islands, due to their limited draft, pose a unique threat for the oil and gas industry as they can drift into much shallower water than other icebergs. This possibility increases the risk to current facilities as well as for the placement of new facilities, even as many move to locations on the Grand Banks. The sheer mass of an ice island makes its threat to a facility very great and limits many currently employed iceberg management techniques (i.e. towing). The needs and concerns of the oil industry and the responsibilities of the International Ice Patrol make the study of ice islands, similar to that tracked during the 2002 season very interesting.

One of the agencies that is highly involved in iceberg tracking for a number of different organizations is the Environmental Services division of Provincial Airlines Limited (PAL). PAL is a privately owned Canadian company that performs contract sea ice and iceberg reconnaissance for the Canadian Ice Service, Department of Fisheries and Oceans Canada (DFO) as well as private industry clientele. PAL, during the height of the ice season, engages in iceberg reconnaissance and management for the Grand Banks offshore oil and gas industry. Specifically, PAL tracks icebergs in the vicinity of oil and gas facilities and moves (tows) icebergs if necessary to eliminate the threat to platforms and rigs.

Ice Season 2002

During Ice Season 2002, the International Ice Patrol, Provincial Airlines Limited and the DFO tracked a very large tabular iceberg during its journey from above 51°N until it was lost south of 46°N at which point it had broken into a number of smaller pieces. The last recorded position of the largest piece of the ice island was recorded on 27 May in position 46°18'N / 46°33'W. Figure 1 graphically depicts the sighting/drift history of the ice island. While IIP was interested in this ice island throughout its transit through the North Atlantic, of special importance is the fact that this ice island crossed south of 48°N on about May 12, 2002, where it began to potentially threaten the normal transatlantic shipping routes. A rough idea of the iceberg's drift speed can be calculated from the approximate date and position that the ice island emerged from sea ice to its last recorded position. Using the iceberg's position on April 18 (49°53'N / 52°45'W) and May 24 (46°18'N / 46°33'W) we can infer generally southeasterly drift at .3 knots (15 cm/s) .

In situ measurements of iceberg size are not simple data to collect. In the case of the ice island, size information was gathered during aerial observation and is therefore a best estimate. Given a known speed over ground, PAL aircraft recorded the amount of time it look to fly from one edge of the ice island to the other along its main axes, thus the sizes noted in Table 1. The size information available to IIP for the ice island on 27 May was gathered in a different, more accurate way, producing the iceberg "growth" noted in the table. This ice expansion is most probably the result of differing measurement techniques and is not terribly important except to note that the largest piece of the ice island was still enormous as far south as 46°N. The size measurements can be used to determine estimates of iceberg mass. Using the simple expression.

$$l * w * thickness * .9 = mass$$

where l and w represent length and width respectively. Thickness is not listed in Table 1 and .9 represents a nominal value for the mass of 1 cubic meter of ice. Mass estimates are listed in Table 1. The size measurements recorded on dates previous to May 10 were too crude to facilitate any mass calculations.

1) The starting date and position used for this estimate of speed was very close to the sea ice edge; however, the plotted distribution and extent did not seem to warrant exclusion of this point as the limited sea ice would likely have had little impact on the drift of the ice island.

Date	Sighting Source	Description/Size	Notes
26 March	DFO	• 7 km long	
06 April	DFO	• 2 km long • 1.8 km long	
18 April	DFO		
10 May	PAL ice flight	• 1-2 km long	
13 May	PAL ice flight	• 200 m long x 100 m wide • 355 m long x 206 m wide • 400 m long x 200 m wide • 500 m long x 290 m wide	Side-scar sonar • ~1.3 Million Tons • ~4.9 Million Tons • ~5.3 Million Tons • ~12.6 Million Tons
23 May	Vessel		• 2 large pieces
27 May	National Ice Center	• 222 m long x 137 m wide • 612 m long x 420 m wide	• ~2.5 Million Tons • ~30 Million Tons

Table 1: Summary of sighting information.

A Historical Perspective

The extensive data collected throughout the rich history of IIP make it fairly easy and quite interesting to consider the ice island of 2002 in relation to similar sightings of the past. To put this iceberg into an historical framework, one must consider the reputable sightings recorded over the period being discussed. Potentially there is not a source more reputable than the annually produced report of the International Ice Observation and Ice Patrol Service in the North Atlantic Ocean. This report documents the activities and findings of IIP for every year in which the Ice Patrol service has been operated. An interesting and enlightening story regarding an ice island occurred in May of 1945 and was reported in Bulletin No. 32: International Ice Observation and Ice Patrol Service in the North Atlantic Ocean - Season of 1946:

Several very large flat-topped bergs were reported, an example of which was the berg reported on the 27th in position 43°08'N / 49°18'W. This berg measured about 4,500 feet long, 3,300 feet wide, and its above-water height was approximately 50 feet. Growlers and debris from the huge block of ice were scattered over a radius of 5 miles. One of the last of the large North Atlantic convoys approached this great floating mass while in dense fog of the 27th and in the confusion that followed 21 ships were damaged. Two of these ships were reported to have suffered damage in collisions with ice and the remaining 19 to have suffered damage in collisions with each other. ... All ships were able to proceed under their own power and no loss of life resulted.

The impact from the ice island, both figuratively and literally, was immediately felt as the Admiralty and Chief of Naval Operations issued, on May 28, 1945, a joint order that abolished convoys and forced all merchant ships to burn navigation lights at full brilliancy and not darken ship.

Additionally, even though North Atlantic ice patrol services had not be officially re-established, the United States Atlantic Fleet inaugurated twice-daily broadcasts from Argentia, Newfoundland at 0200 and 1400 GCT to shipping commencing on 8 June, 1945 as well as detailing a surface vessel patrol to the Grand Bank region (GPO, 1947).

While having not quite the same impact on transatlantic shipping as the ice island of 1945, the iceberg of 2002 is interesting in its own right. The documentation maintained by IIP and the research completed by Newell (1993) allow a fairly good picture of the ice island sightings since about 1912. For the purposes of his research, Newell (1993) defined ice islands in a much more specific manner than the general characteristics noted in Bowditch (2002). Newell considered a flat-topped iceberg an ice island if it was reported to be longer than 500 meters when north of 50ºN and one longer than 300 meters when south of this latitude. The first documented sighting of an iceberg meeting these criteria was in 1911. During June of that year, an iceberg more than two nautical miles (>3.7 km) long was noted off Southern Labrador. This particular iceberg was stranded all season and rapidly diminished, deteriorating to approximately .75 miles long by .25 miles wide and 60 ft high when it was photographed in July. Since that date, documented sightings have been made quite often. Dramatically increasing with IIP and the Canadian Ice Service patrols further north, very large iceberg sightings started increasing during after the 1920's and with advent of aerial iceberg reconnaissance in 1946, the accuracy level of very large iceberg reports has improved.

Ice Season severity, as determined by the Ice Patrol, does not seem to be a good indicator of years in which ice islands are sighted in the vicinity of the Grand Banks. Based on many years of data, season severity indicators were developed by Trivers (1994) and defined as mild, moderate and extreme based on length of ice season and the count of icebergs crossing south of 48°N. Extreme years, or those with more than 600 icebergs crossing 48°N and/or lasting more than 180 days, are not highly correlated with the sighting of very large icebergs. This position is further supported by Newell (1993), where he mentions that a very large iceberg could potentially have a dramatic effect on the iceberg population on the Grand Banks if it were to break up. If one considers that a 3 km long by 1.5 km wide iceberg has a mass on the order of 100 million tons and a "standard" medium iceberg on the Grand Banks might be 100 meters by 100 meters with a mass on the order of 100,000 tons, it is easy to see that the larger mass of ice could potentially produce ~1,000 medium icebergs. Fortunately, this does not seem to be the case or even a common occurrence as the correlation between very large iceberg sightings and severe iceberg years is low. An additional conclusion that is possible from this circumstantial data is that global warming does not seem to have an effect on the production of very large icebergs. If global warming did tend to cause an increase in production of very large icebergs, we would expect to see increased sightings in the vicinity of the Grand Banks as estimates of global temperatures have risen. Ice island sighting data does not support such a claim.

2) As noted by Newell (1993), the ice island sighting record is potentially biased by ice research programs and sighting methods (aircraft vs. ship) that have changed (i.e. made identification easier and subsequently increasing the number of reports). The majority of data gathered by Newell was obtained from International Ice Patrol iceberg sighting records.

The work of Newell (1993) found that the maximum length of icebergs north of 50°N remains fairly constant while the length decreases rapidly south of 50°N. Clearly a result of higher sea surface temperatures and wave action (open water conditions), the rapid deterioration of very large icebergs south of 50°N is a key factor for consideration by the oil and gas industry. Robe (1977) conducted extensive photo-documentation of the deterioration of an ice island during May and June 1976. He noted a tremendous effect from wave erosion, undercutting, and minor calving. Wave erosion had the most profound effect as it tended to focus its energy on the small irregularities along the face of the iceberg. Indeed, Provincial Airlines' interest (and more directly their clients') is easily justified when one considers the fact that a piece of ice weighing approximately 30 million tons passed within 60 nm of a fixed oil production facility during late May.

The very large tabular iceberg of 2002, while not the largest on record, is certainly one of the largest seen in recent times by the International Ice Patrol and other operators on the Grand Banks. These phenomena, while remarkable to behold, are not the "Jaws" of the transatlantic mariner as their size and near vertical faces typically present excellent radar returns.

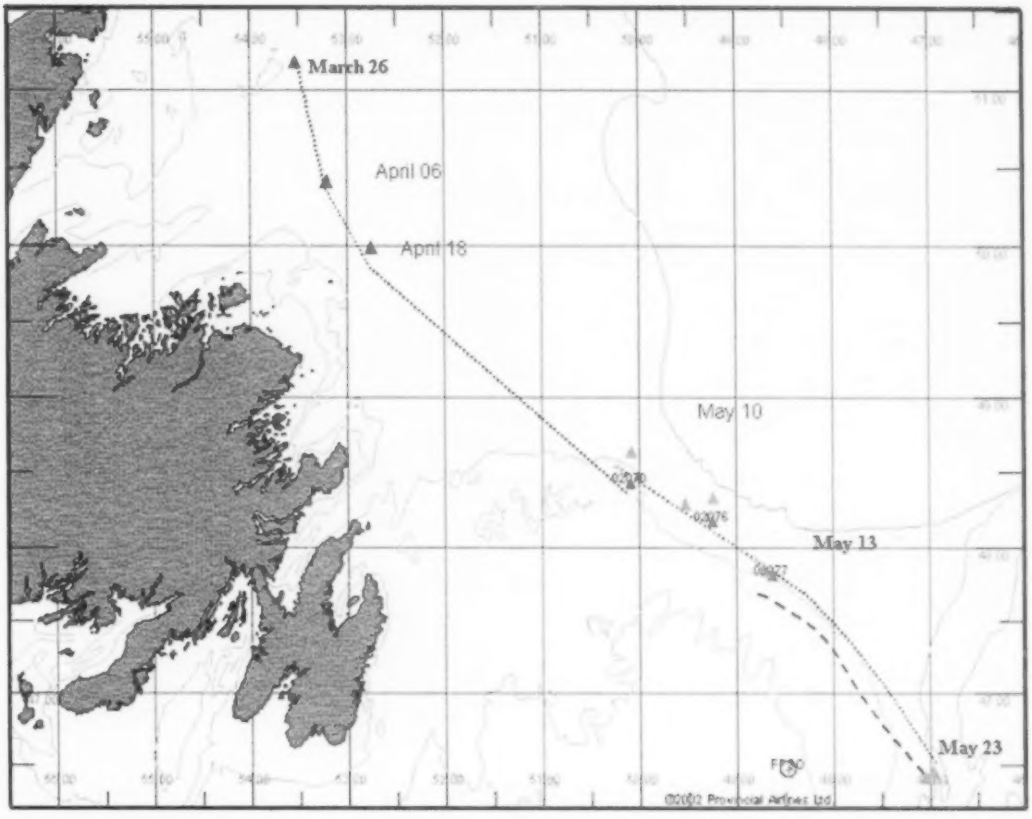


Figure 1: Sighting history of very large tabular iceberg as provided by Provincial Air Lines.

Additionally, their size lends to more accurate tracking by the agencies responsible for monitoring ice danger in the North Atlantic.

Acknowledgments:
LT Stoermer would like to thank Dr. Don Murphy for his insight and critical review of this article.

Works Cited:

Bowditch, N., American Practical Navigator, Pub. No. 9, 2002.

Dykstra, P., Monster iceberg breaks off AntarcticShelf, *http://www.cnn.com/2002/TECH/space/05/09/iceberg.satellite*, 10 May 2002.

International Ice Observation and Ice Patrol Service in the North Atlantic Ocean - Season of 1946, Bulletin No. 32, Government Printing Office, Washington, 1947.

Newell, J. P., Exceptionally Large Icebergs and Ice Islands in Eastern Canadian Waters: A Review of Sightings from 1900 to Present, *Arctic*, 46, 205-211, 1993.

Robe, R. Q., D. C. Maier, and R. C. Kollmeyer, Iceberg Deterioration, *Nature*, 267, 505-506, 1977.

Trivers, G. A., International Ice Patrol's Iceberg Season Severity, *Report of the International Ice Patrol in the North Atlantic*, 80, 49-59, 1994.

Season Severity by Three Variable Index: LAKI Area, Length of Season, Iceberg Population below 48 N

Cadet 1/c Victoria Futch
Donald L. Murphy

Introduction

When International Ice Patrol (IIP) began to measure season severity, the main method was to count the number of icebergs crossing south of 48 N during the season. It is not clear why 48 N was chosen, but it is likely it was viewed as the latitude below which icebergs were considered a menace to the transatlantic mariners. The first time Ice Patrol took an interest in season severity measurements was in 1926 with the publication of Edward H. "Iceberg" Smith's, "Summary of Iceberg Records in the North-West North Atlantic." In this publication, Iceberg Smith compiled actual iceberg counts of those crossing 48 N from 1880-1926. After this, the number of icebergs crossing 48 N became a standard statistic in IIP's annual bulletins. Over the years, this statistic has become the standard indicator of iceberg season severity.

However, the interpretation of the season severity measure has varied over the years. For example, Alfultis (1987) defined four iceberg-population severity classes starting at 300 icebergs or fewer for a light year and over 900 icebergs for an extreme year. Trivers (1994) modified the interpretation and defined a light year as one with 300 or fewer icebergs but defined an extreme year as 600 or more icebergs.

For the mariner, the number of icebergs present in the shipping lanes is not the only factor that indicates the severity of an iceberg season. The area enclosed by IIP's Limit of All Known Ice (LAKI), which defines the iceberg danger area, and the length of the iceberg season (LOS) are also very important factors to the mariners.

If the iceberg population is widely distributed and persists over a long span of time, the mariner may also view the season as severe, even though there might not be an extraordinary number of icebergs south of 48 N. Each of the three factors costs the mariner money when they are forced to delay or divert due to ice. In an effort to create a more accurate description of season severity, a new index has been created using three variables: the area south of 48 N enclosed by LAKI, iceberg population south of 48 N and LOS.

Methods

The LAKI, LOS, and number of icebergs passing south of 48 N were taken from IIP's annual bulletins from 1975-2001. As part of Ice Patrol's routine operations, LAKI is determined twice a day, every day during the entire ice season. It is a line that encompasses all known icebergs in the northwestern Atlantic Ocean, thus defining the iceberg danger area. A typical LAKI originates near the coast of Newfoundland, proceeds southeastward over the Grand Banks, and then northward to 52 N, where the Canadian Ice Service takes over the responsibility for defining the iceberg danger area.

The bulletins from 1981 to 2001 contain LAKI plots for the 15th and 30th (or last) day of each month. Before 1981, the LAKI plots were not consistently published on any particular day, but there were enough plots to produce a twice-a-month record. Data from 1975-1980 were taken from the day as close to the 15th or 30th of the month as possible. Exact dates are nominal, and the slight difference between dates in some months does not affect the results of the calculations. In the annual bulletins before 1975 the LAKI information was not as regular as the more recent bulletins and could not be used.

The geographic coordinates that form the LAKI were hand-measured from the plots in the bulletins and entered into the program created by Wright (2002). This program simply divides the area enclosed by the LAKI into sub-areas, calculates the area of each sub-area and sums the results. The computation is based on three assumptions: (1) that the area of interest is between the LAKI and 48 N latitude, (2) for each sub-area integrated, the average latitude was used to determine the east-west distance, and (3) the land area included in the calculation is negligible. Assumption (3) is required because the most common origin of the LAKI is near the southern or southwestern Newfoundland coast; thus, a part of Newfoundland's landmass becomes incorporated into the computed LAKI area.

If the origin of the LAKI is far to the west on Newfoundland, it will result in a large LAKI area, therefore minimizing the effect of the land. If the origin is far to the east, the landmass enclosed by the LAKI will be small, again minimizing the error. So, although a portion of Newfoundland is in the result of every calculation, this error is not significant.

Before combining the three factors into the season severity index, each factor was normalized using the mean value for the 27-year record. The LAKI area was first averaged by month for each of the years (1975-2001) and then by year (all months during ice season). The mean value of the LOS and number of icebergs that passed south of 48 N were also computed.

Finally, all three were combined to form the Normalized Season Severity Index (NSSI):

NSSI = LAKI Area/90,234 + LOS/143 + S48N/702

where LAKI area is the average area covered by the limits of all known ice during the ice season, LOS is the length of season, and S48N is the iceberg population south of 48 N. The three denominators are the 27-year means for LAKI area, LOS, and icebergs south of 48 N.

Discussion

Normalized Season Severity Index (NSSI) Accuracy

An aggregate plot of all seasonal computations (Figure 1) shows the characteristic behavior of the LAKI area throughout a season, with a peak area in late spring. The plot was created with monthly LAKI areas from 1975-2001. The ideal normal curve season would open in early March, peak in late May, and dwindle down to a close in mid to late August. The NSSI uses an average length of season of 143 days to normalize the LOS data. The average season length allows an early March opening and late July ending of the ice season.

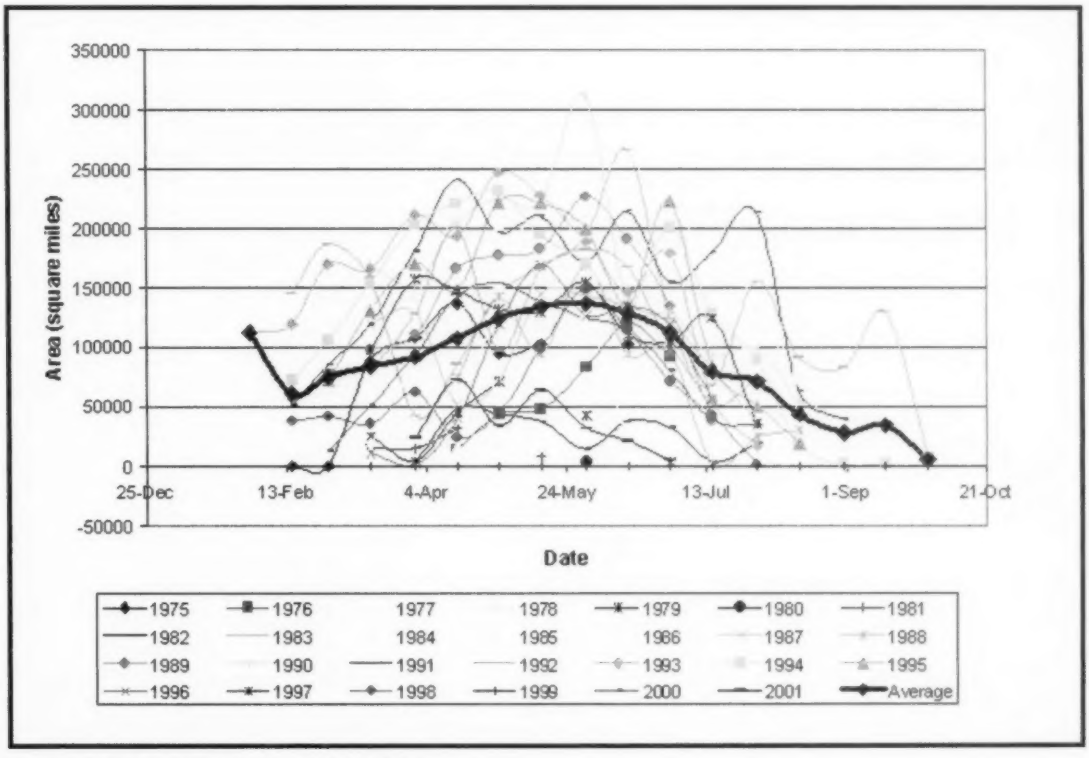


Figure 1. LAKI Area Compilation (1975-2001)

Figure 2 shows the NSSI for all years from 1975 to 2001. The noticeable severe years by the NSSI were the years 1984, 1991 and 1993 with NSSI values of 5.72, 5.77 and 5.48, respectively. The least severe year was 1999 with an NSSI rating of 0.03. When compared to the previously used index of season severity, icebergs south of 48 N, the three most severe years of the study period were 1984, 1991, and 1994 with iceberg populations of 2202, 1974 and 1765 respectively. The lightest years were 1977, 1980 and 1999 with 22, 24 and 22 icebergs, respectively.

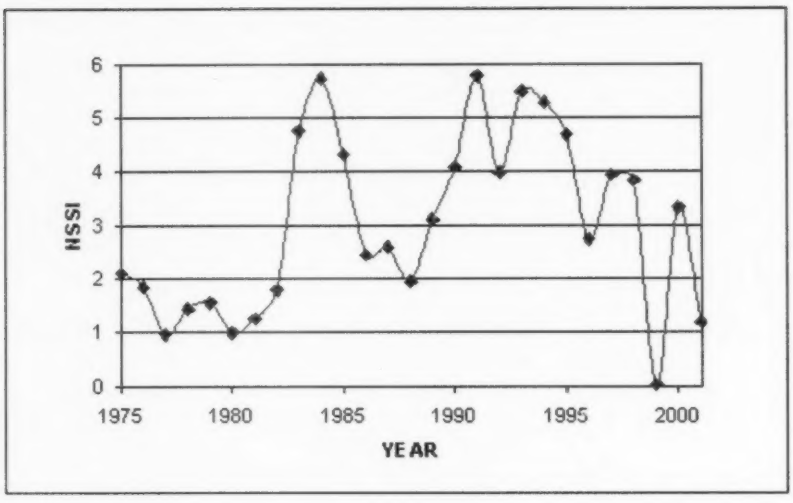


Figure 2. Normalized Season Severity Index (1975-2001)

Although the number of icebergs that pass south of 48 N during a year plays a large role in the overall NSSI value, the additional factors of LAKI area and LOS can cause different relative rankings among season severities. Take the three most severe years by iceberg count and NSSI. By iceberg count alone, the most severe years are 1984, 1991, then 1994. Using the NSSI, the most severe year is 1991 followed by 1984, then 1993, thus reversing the positions of 1984 and 1991 as the year considered to be the worst iceberg year in IIP's history. Table 1 shows a detailed comparison between the 1984 and 1991 iceberg seasons. It shows the contributions of each of the three factors (LAKI area, LOS and iceberg count) to the NSSI and the ranking in each of the areas. The 1991 ice season had an average LAKI area of 151,234 nm2 (Figure 3) with a season lasting 183 days. Both of these factors contributed to its place as the most severe iceberg season during the study period severity of the 1991 season. In comparison, the year 1984 had 2,202 icebergs south of 48 N, an average LAKI area of 125,802 nm2 (Figure 4) and a season lasting 170 days.

Year	LAKI area (nm^2)	NSSI rating/rank (area)	Length of season	NSSI rating/rank (LOS)	Icebergs south of 48°N	NSSI rating/rank (icebergs)	Overall NSSI rating/rank
1984	125,802	1.39 / 10	170	1.19 / 7	2202	3.14 / 1	5.72 / 2
1991	151,234	1.68 / 3	183	1.28 / 4	1974	2.81 / 2	5.77 / 1

Table 1. Differences in NSSI ratings between 1984 and 1991

Figures 3 and 4 show how the LAKI area changed throughout the 1991 and 1984 iceberg seasons, respectively. In the case of 1991, the LAKI area was near 200,000 nm2 for the period from early April through mid July. The LAKI area distribution for 1984 was close to the classic normal distribution with a peak in late May. Using the iceberg count alone, this effect is not considered, thus the severity of the season from the standpoint of the mariner was not represented. From the mariner's viewpoint, the 1991 iceberg season was somewhat more severe than 1984 because the iceberg danger area was very large for a greater length of time, despite the fact that in 1984 there were over 200 more icebergs during the season.

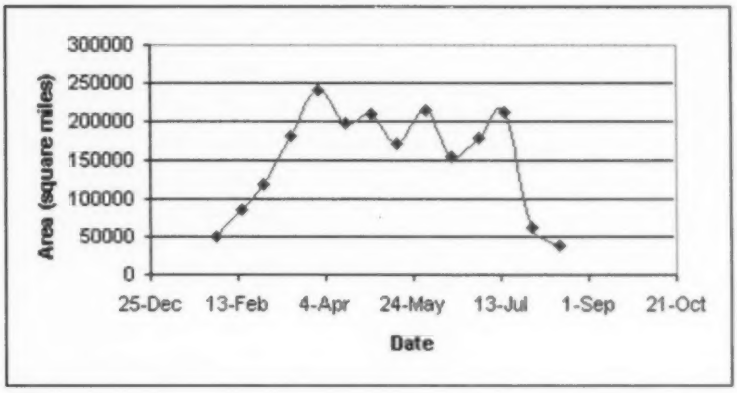


Figure 3

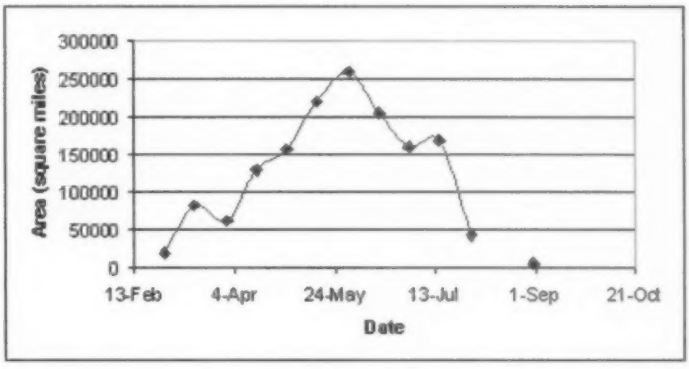


Figure 4

Another example of the differences between the NSSI and iceberg count is the difference between the ranking of the years in 1997 and 1998 (Table 2). In 1998, the season had almost half of the average LAKI area of 1997. This made a large impact on the season severity, but was countered by the higher number of icebergs in the 1998 season as compared to 1997. By NSSI, they had very similar values, 3.83 and 3.71, respectively. By iceberg count alone, 1998 would have been considered to be a much more severe season than 1997 because it had over 30% more icebergs south of 48 N.

Year	LAKI area	NSSI rating/rank (area)	Length of season	NSSI rating/rank (LOS)	Bergs south of 48°N	NSSI rating/rank (bergs)	Overall NSSI rating/rank
1997	119,436	1.32 / 11	164	1.12 / 8	1011	1.44 / 10	3.83 / 10
1998	60,358	0.67 / 19	168	1.14 / 7	1380	1.96 / 6	3.71 / 9

Table 2: 1998 and 1997 comparison

NSSI Parameters

The parameters for the NSSI were created using a stem and leaf plot to find the 25th, median, 75th, and 90th percentiles for each variable in the NSSI. The values (Table 3) provided grounds to calculate the various levels of season severity. Below the 25th percentile is used for a light season. Moderate is from the 25th to the 75th percentile, a heavy season is 75th to 90th percentiles and an extreme season is over the 90th percentile.

	LAKI Area	Length of Season	S48N
25th %	44,419	122	98
Median	111,041	152.5	309.5
75th %	159,201	168	1135
90th %	201,755	182.9	1757

Table 3. 1975-2001 Iceberg Percentiles

By entering the percentile variables into the Season Severity Index, the ratings given can be used to define an accurate severity to each year (Table 4). By using the averages of the data for each variable, the normal season severity was found to have an NSSI rating of 3.00 where the median had an NSSI rating of 2.69 showing a slight right skew in the data. This skew is due to a large quantity of data on the lower end of the NSSI spectrum.

Normalized Season Severity Index	
Light	< 1.45
Moderate	1.45 – 4.25
Heavy	4.25 – 5.00
Extreme	> 5.00

Table 4. Final NSSI Rating Categories

The percentiles were used as guides to create the rankings for light, moderate, heavy, and extreme years, but they were not the deciding factor. The averages for each variable and frequency of occurrence were taken into account to create a more accurate representation of season severity.

Comparison of NSSI to Previous Standards

Most recently, Trivers (1994) updated the International Ice Patrol's season severity classification based on the number of icebergs that passed south of 48 N during a season. Trivers based his data upon Alfultis (1987) results on season severity, but tried to take into account the difference in iceberg data collection methods. He examined the difference between the pre-SLAR (Side-Looking Airborne Radar) years and the SLAR years. In the pre-SLAR years, Trivers notes that an extreme year in the terms that Alfultis set are average under SLAR years. This difference could be the result of either better detection due to increased technology or natural variations in iceberg counts and distribution. If the increase is due to technology, then this may have an effect on the results of the NSSI, however Trivers found that the pre-SLAR years had not been undercounted. Trivers created new iceberg population severity classes as shown in Table 5. By comparing these severity classes by the data used for the NSSI, the severity classes used by Trivers seem to be low compared to the NSSI data. The average number of icebergs below 48 N was 702 for NSSI years whereas in Trivers the extreme year was classified as 600 plus icebergs. Using Trivers' (1994) standards to classify the NSSI data, 13 of the 27 years would have been classified as extreme, whereas using NSSI rankings, only 4 years were classified as extreme.

Trivers (1994) Iceberg Population Severity Classes	
Light	< 300 icebergs south of 48 ° N
Moderate	300-600 icebergs south of 48 ° N
Extreme	> 600 icebergs south of 48 ° N

Table 5. Trivers (1994) Severity Classes

Conclusion

The NSSI rating combines the three most important variables into a single number that indicates of the severity of an iceberg season: LAKI area, LOS and the number of icebergs that passed south of 48 N. The previously used indicator, the number of icebergs south of 48 N, provided information only on the number of icebergs that entered the shipping lanes, without regard to how far they spread or how long they persisted. The NSSI focuses on the severity of an iceberg season from the standpoint of the transatlantic mariner, IIP's most important customer, because it represents the areal and temporal extent of the iceberg threat during a given season.

The NSSI is also a good indicator of the effort required for IIP to provide its services during a season. A season with a large number of icebergs concentrated near the Grand Banks is far less challenging than a season with a smaller number of widely distributed icebergs. The most important result of a wide iceberg distribution or a long season is the requirement for a greater number of aircraft hours needed to conduct reconnaissance. Thus, the NSSI can be used to compare iceberg seasons with differing iceberg populations in an effort to determine trends in IIP's efficiency.

There are some drawbacks to using the NSSI as an indicator of season severity. The most significant is that the information required to calculate the NSSI is not available for as long a period as the iceberg counts. The iceberg count extends to the late 1800s, while the NSSI can be computed with confidence back to 1975. In addition, many users of the season severity information are interested only in a specific area, so the iceberg count is a satisfactory indicator. These users include the offshore oil industry and other local marine interests.

References

Alfultis, M., 1987: Iceberg Populations South of 48N Since 1900, Report of the International Ice Patrol Services in the North Atlantic, Bulletin No. 73, Appendix B, pp. 52-62.

Smith, E., 1926: Summary of Iceberg Records In the North Western North Atlantic, 1880-1926, Report of the International Ice Patrol Services in the North Atlantic, Bulletin No. 15, pp 75-77.

Trivers, G., 1994: International Ice Patrol's Iceberg Season Severity, Report of the International Ice Patrol Services in the North Atlantic, Bulletin No. 80, Appendix C, pp. 49-59.

Wright, Greg, 2002: LakiArea2 program

Detecting Marine Winds from Space: An Introduction to Scatterometry and the Current Operational Scatterometers

Jamie R. Rhome
Tropical Analysis and Forecast Branch
NOAA/Tropical Prediction Center/National Hurricane Center

Introduction

Weather analysis and forecasting over the open ocean remains a significant challenge given the relative lack of in-situ observed data as compared to terrestrial areas. While ship observations and buoys go a long way toward filling these gaps, there still exist areas of data void. Thus, forecasters must rely on satellite remote sensing techniques to fill in the large data gaps for these areas. The traditional application of satellite data has been weather surveillance for locating weather features and estimating their intensity based on cloud temperatures and patterns. This application, however, has some limitations since it provides little information on variables such as surface winds. Thus, estimating surface wind can be particularly problematic, especially if there are no nearby ship observations. More recently, a wealth of advanced satellite technology and instrumentation has been introduced, which now allows the estimation of surface and near-surface winds from space. One of the most applicable developments for the marine community is scatterometry, the only satellite-borne technology capable of estimating wind speed and direction with nearly global daily coverage. This paper provides a brief introduction into scatterometry, its application to the marine community, and a description of a new scatterometer instrument to begin operations during fall of 2003.

Scatterometry

Scatterometers are satellite-borne microwave radar instruments, which send out a series of specific signals or pulses and then measure how much of that signal or energy is returned.

Microwaves have sufficiently high frequency to penetrate clouds, thus overcoming limitations of the more traditional weather satellites (e.g. Geostationary Operational Environmental Satellites or GOES), which measure lower-frequency infrared and visible radiation.

The amount of energy returned to the instrument, also known as backscatter, is primarily a function of reflection and scattering off the ocean surface.

This backscattered energy varies according to the sea surface roughness caused by small (on the order of centimeters) wind generated waves also known as capillary waves.

Rough seas reflect a stronger signal than calm and this difference in backscattered energy is used to estimate the wind speed.

The backscattered energy is technically a measure of surface stress rather than the near-surface wind, which means it must be converted to wind speed using empirical relationships (Atlas et al. 2001).

The wind speed is also corrected for stability and adjusted to a standard height. Thus, wind measurements from scatterometers are indirect estimates, not observations, and reflect the wind speed at 10 meters under neutral stability (Atlas et al 2001). While the amount of backscatter determines the wind speed, the orientation of the backscattered energy with respect to propagation of the original pulse determines the wind direction.

Scatterometers measure the amount of backscattered energy from multiple directions or different angles depending on their scanning geometry. This provides up to four different possible solutions for the wind direction. The most likely wind direction is determined by identifying the best fit between the wind direction and observed backscatter from the different angles. Typically, the best fit corresponds to the true direction while the next best fit corresponds to the opposite direction.

Scatterometer instruments are typically deployed on sun-synchronous near-polar-orbiting satellites that orbit the earth in a fashion such that they pass over the equator at approximately the same local times each day. These satellites orbit at an altitude of approximately 800 km (~ 500 statute miles) and are commonly known as Polar Orbiting Environmental Satellites (POES). This orbit and lower altitude differs from the more commonly known GOES satellites, which orbit above the equator at an elevation of 22,240 miles. GOES satellites orbit above the Earth at a speed which matches the Earth's rotation, thus allowing them to hover or remain stationary over one position above the earth. Conversely, POES satellites complete fourteen daily near polar orbits each taking approximately 100 minutes to complete. This orbit allows roughly two passes over any geographical location per day. Modern scatterometers deployed on POES can thus provide nearly global daily coverage via a series of 1800 km wide swaths (Figure 1), as opposed to the GOES which has more limited overall coverage. Also, the POES lower earth orbit improves resolution, allowing more detailed monitoring of the ocean surface.

Another difference between GOES and scatterometer instruments is that GOES sensors do not send out a signal but simply measure radiation emitted from the earth. For this reason, scatterometers are known as active sensors while sensors on the GOES are known as passive. Additionally, because scatterometers employ a microwave signal which can penetrate clouds, they can sample the earth's surface under most weather conditions day and night. Conversely, GOES weather satellites are unable to see through cloud cover, thus limiting their ability to provide information of surface conditions during many weather situations.

Scatterometers Past and Present

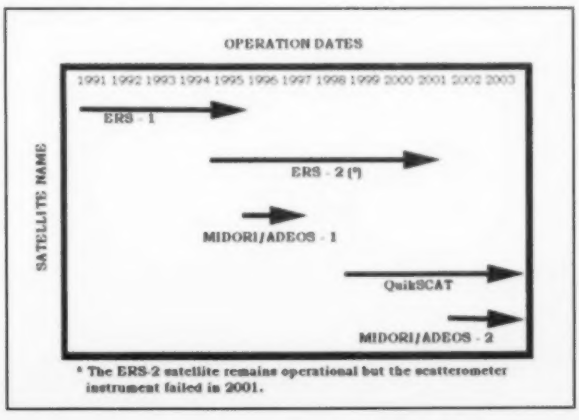
The history of scatterometry dates back to World War II when radar observations over oceans contained clutter from signal returns off unknown sources. During the 1960s, this clutter was found to be due to the effects of wind. This led to the first tests of space based scatterometry during the Skylab missions of 1973 and 1974. These relatively short missions were followed by the deployment of the SeaSat-A Satellite Scatterometer (SASS). The SASS was a Ku band (microwave frequencies near 14 GHz) radar designed specifically for monitoring the ocean surface. It had antennas equipped on both sides of the satellite, which allowed for two simultaneous observational swaths approximately 500-km wide separated by a data free region called the nadir gap. The SASS mission operated from June through October of 1978 and demonstrated that accurate winds could be measured from space. The European Remote Sensing (ERS) satellites (Figure 2) later followed the SASS and marked the beginning of nearly continuous scatterometer coverage. . The ERS satellites were equipped with a C band (~ 5 GHz) scatterometer with 25 km resolution. These scatterometers utilized three antennae that generated radar beams looking 45 degrees forward, sideways, and backward with respect to the satellite's flight direction.

The multiple beams allowed three different viewing angles of any particular point with different incidence angles and covered a 500 km-wide swath. The first ERS satellite (ERS-1) operated from 1991-1995 with the successor, ERS-2, becoming operational in 1995. While the ERS-2 satellite remains operational, the scatterometer failed in 2001. However, the radar altimeter equipped on the ERS-2 continues to provide sea height measurements. In 1996, the National Aeronautics and Space Administration (NASA) began a joint mission with the National Space Development Agency of Japan to maintain continuous scatterometer missions beyond ERS satellites. The first scatterometer via this joint effort was the NASA scatterometer (NSCAT) aboard the Advanced Earth Observing Satellite (ADEOS). The NSCAT was similar to SASS in that it employed antennas on each side of the satellite, allowing two simultaneous swaths but with slightly improved swath widths (~ 600-km). The Ku band NSCAT instrument operated with 50 km resolution and collected data for 9 months prior to prematurely losing power in 1997. NASA's solution to the failed NSCAT was the QuikSCAT mission (for Quick Scatterometer), which was launched in 1999. To date, the Quikscat satellite remains in operation, far outlasting its 2-3 year mission life expectancy. The QuikSCAT mission includes a more advanced scatterometer instrument (called SeaWinds) that utilizes a conical scanning technique. This novel technique employs rotating dish antennae that eliminates the nadir gap and increases the swath width to approximately 1,800 km.

The improved sampling size allows approximately 90% of the earth's ocean surface to be sampled on a daily basis as opposed to two days by NSCAT and four days by the ERS instruments. The new scatterometer also has much improved horizontal resolution (25 km) over the 50 km NSCAT. Wind estimates taken by QuikSCAT are currently available to forecasters within about three hours of the observation time. Wind estimates are accurate within two meters/sec for speed and 20 degrees for direction in rain-free areas. The newest scatterometer instrument (commonly known as SeaWinds) was launched in December of 2002 onboard the ADEOS-2 satellite, later named Midori 2. SeaWinds on Midori 2 (Figure 3) is very similar to the SeaWinds on Quikscat and was first activated in January 2003. A six-month calibration/validation phase began in April, and regular operations are currently scheduled to begin this October. SeaWinds on Midori 2 will initially complement and eventually replace the existing Quikscat scatterometer. It is expected to last three to five years (Figure 2).

Figure 2. Schematic illustration of past, present, and future scatterometer instruments.

In addition to the Seawinds scatterometer, the Midori 2 satellite is also equipped with an Advanced Microwave Scanning Radiometer (AMSR). The AMSR instrument detects microwave emissions from the Earth's surface and atmosphere and is able to measure various parameters such as precipitation. (continued next page)


OPERATION DATES
1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003
SATELLITE NAME
ERS - 1
ERS - 2 (*)
MIDORI/ADEOS - 1
QuikSCAT
MIDORI/ADEOS - 2
* The ERS-2 satellite remains operational but the scatterometer instrument failed in 2001.

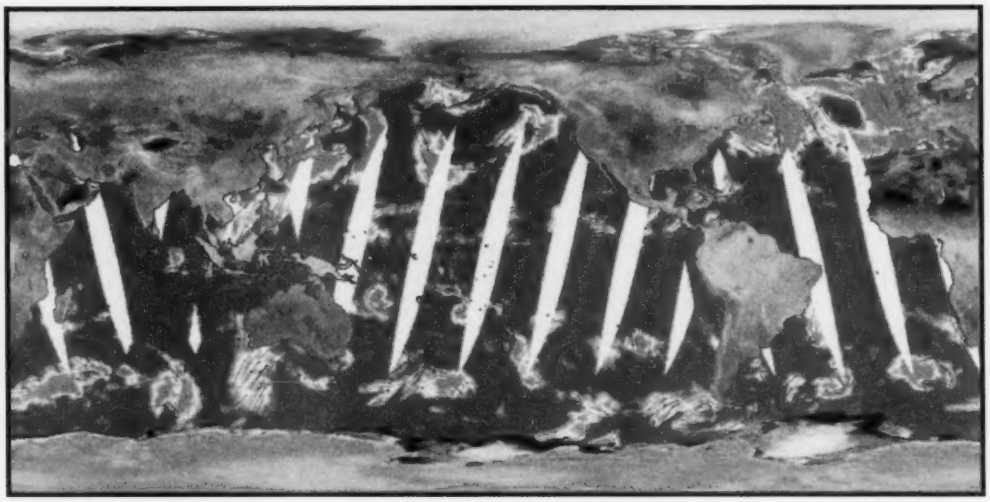


Figure 1. First image from the new Seawinds scatterometer on the Midori 2 satellite taken during January 28-29 2003. The image shows the typical daily coverage (~ 93% of ocean surface) that can be achieved with modern scatterometers. White regions indicate unmeasured areas between the satellite swaths (viewing area).

The ability to measure precipitation will allow for a more explicit detection of rain which can only be inferred from the current Quikscat instrument. This should improve the quality control of wind retrievals within and near areas of heavy rain, a major difficulty with the current Quikscat. This is discussed further in the limitations section below. An example of estimated surface marine winds from Seawinds on Midori 2 is shown in Figure 1.

Marine Forecasting Application

There are many marine applications of scatterometer data including improved surface weather and sea state analyses, warnings, and forecasts. Scatterometers provide increased data availability over the oceans and fill in gaps between ship observations. The increased data aids in locating weather features such as fronts, troughs, high and low pressure centers, and surface circulations associated with developing tropical cyclones (TC). These features can have a large impact on both the current and forecast wind field and sea state. Scatterometer data has also greatly improved the determination of the TC wind radii, which has far reaching implications for both marine interest as well as pre-landfall emergency preparations. Atlas et al. (2001) provide a more comprehensive discussion of the impacts of scatterometer data on operational forecasts. It should be noted that scatterometer data is not a replacement for ship observations. In fact, these two sources of marine observations can complement each other. For example, Rhome (2003) showed an example where a ship observation concurrent with QuikSCAT wind estimates helped validate storm force winds within the Gulf of Tehuantepec. In situations where both ship and scatterometer data are available, there is much more confidence in the issuance of warnings. Cobb et al. (2003) further showed the operational impact of QuikSCAT data for validating marine warnings.

One of the less commonly known applications of scatterometer data is improved initialization and evaluation of numerical weather prediction (NWP) models. Atlas et al. (2001) found that the ability of NWP to use scatterometer data has improved substantially. This has far reaching implications since accurate initialization of NWP models can be directly related to improved forecasts. Without accurate initial conditions, a model's ability to provide accurate forecasts is severely limited. Imagine having very precise directions somewhere without knowing where to start. In effect, those directions are virtually useless. Meteorologists commonly use the phrase "garbage in equals garbage out" to convey that a numerical model with inaccurate initial conditions will produce an inaccurate forecast. For example, Atlas et al. (2001) showed an example from two powerful storms that affected France during December 1999. Control runs of NWP models without QuikSCAT data were unable to detect these features, leaving little warning time. However, similar NWP simulations with the QuikSCAT data included provided more evidence of the developing systems.

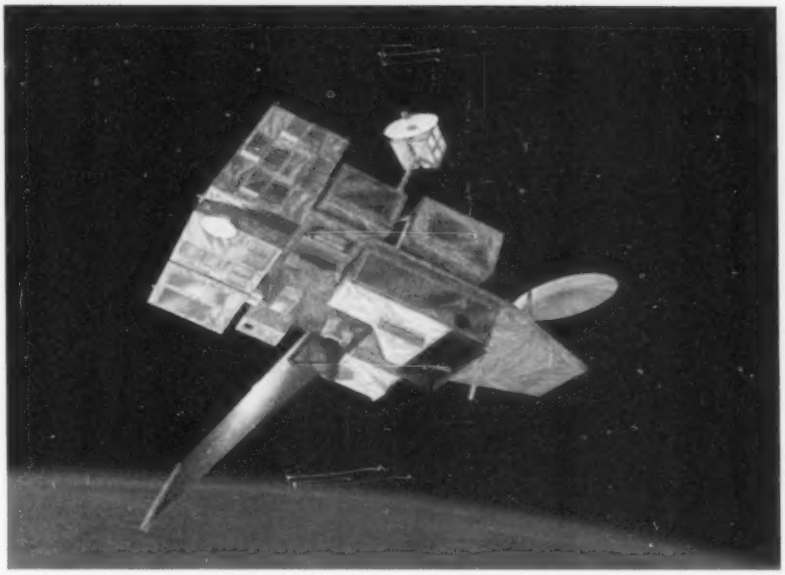


Figure 3. Seawinds scatterometer on the ADEOS-II/Midori 2.

In addition to aiding the initialization of NWP models, scatterometer data also allows forecasters to evaluate the accuracy of the initialization. For example, a feature of interest depicted in NWP output can be compared against the corresponding scatterometer data to determine if that feature is accurately positioned with the correct intensity (i.e., wind speed). This type of analysis is more applicable during situations where scatterometer data becomes available after the model's initialization process. If the NWP model does not properly resolve the particular weather feature in question, then adjustments must be made to the forecast from that model, and/or another model must be utilized. A number of new marine applications of scatterometer data have recently been discovered, including detecting the extent of sea ice and ice concentration, iceberg tracking, and monitoring ice shelves. These new applications should significantly improve marine forecasts and warnings, thus continuing the scatterometer's legacy as the mariner's eyes in the sky.

Limitations

Despite its many applications, scatterometer data is subject to several limitations and ambiguities, many of which can affect the availability and accuracy of the wind estimates. First, since scatterometers are deployed on polar orbiting satellites, data is only available at any given location approximately twice per day. This means that data is not updated continuously (as is the case with GOES satellites). Also the data is often outdated since it is delayed (by 3 hours for the current Quikscat). The forecaster must make adjustments, especially for cases of rapidly evolving weather systems, to compensate for the data delay.

Additionally, gaps exist between the sampling swaths. These gaps are largest over the equator, smaller over the midlatitudes, and non-existent near the poles (Figure 1). This means that the satellite swath can completely miss a particular region or weather system, thus providing little or no wind information for that area. The problem is often compounded since the sub-orbital tracks (track in reference to the earth's surface) do not exactly repeat on a daily basis. The satellite swaths progress from east to west, even though the local solar time of each satellite's passage is essentially unchanged for any latitude.

Essentially, this means that the satellite swath can miss a westward-moving weather system during consecutive passes (often for many days) if the weather system moves at a speed similar to the satellite's progression. In these cases, the scatterometer's application is limited. Ambiguities in the retrieved wind direction are also a problem with scatterometer data. Scatterometers utilize measurements from multiple viewing angles in order to determine wind direction. Since these measurements provide up to four different solutions for direction, a best fit technique must be applied to determine the most likely direction among the possible solutions.

Typically, the best fit corresponds to the true direction while the next best fit corresponds to the opposite direction. The process of determining the best fit can be complicated by noise within the data, especially at low wind speeds when the measured returned signal is weak. Also, determining the best fit is more difficult near the edges of the swath where there are relatively fewer observations due to the sampling process, and near the center of the swath where the ocean surface is viewed with a more limited set of incidence angles. Overall, the accuracy of wind directions near the swath edges, swath center, and within areas of weak flow is erroneous more often than strong winds in "sweet spots" of the swath on either side of the center (Figure 4, following page).

Another limitation of scatterometers is that wind estimates are contaminated by heavy rain. (continued page 19)

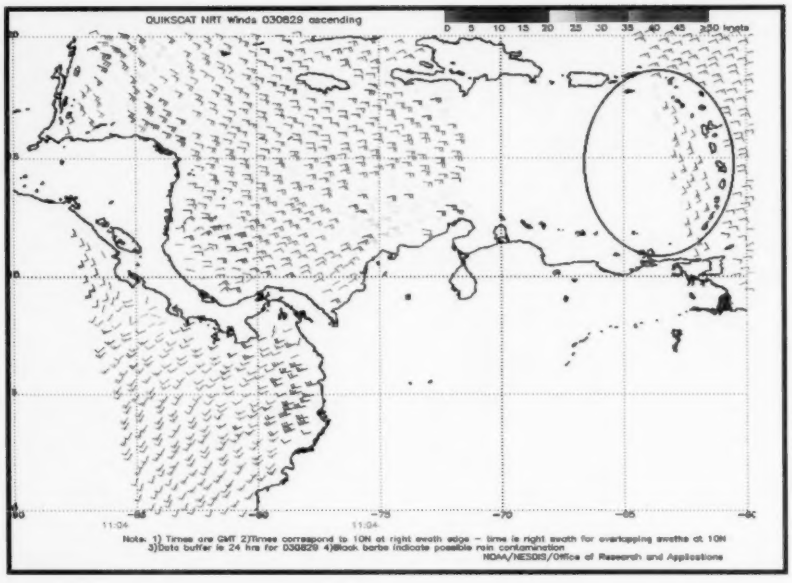

QUIKSCAT NRT Winds 030829 ascending
0 5 10 15 20 25 30 35 40 45 ≥50 knots
Note: 1) Times are GMT 2)Times correspond to 10N at right swath edge – time is right swath for overlapping swaths at 10N
3)Data buffer is 24 hrs for 030829 4)Black barbs indicate possible rain contamination
NOAA/NESDIS/Office of Research and Applications

Figure 4. Example of typical swath edge contamination (shown in circled region) from the ascending pass of Quikscat during August 29, 2003. Note the southerly winds shown by Quikscat are 90 degrees off from the true easterly flow shown surrounding the encircled region.

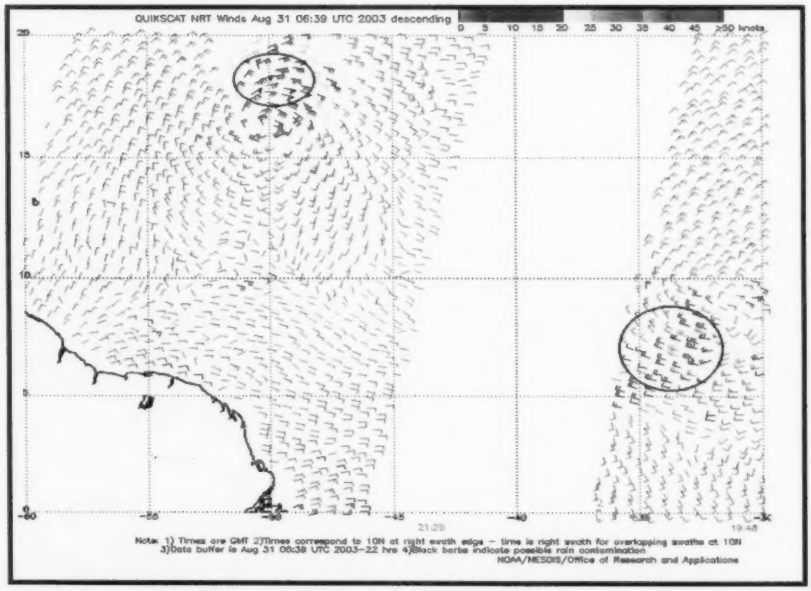

QUIKSCAT NRT Winds Aug 31 06:39 UTC 2003 descending
0 5 10 15 20 25 30 35 40 45 ≥50 knots
Note: 1) Times are GMT 2)Times correspond to 10N at right swath edge – time is right swath for overlapping swaths at 10N
3)Data buffer is Aug 31 06:39 UTC 2003–22 hrs 4)Black barbs indicate possible rain contamination
NOAA/NESDIS/Office of Research and Applications

Figure 5. Examples of rain contamination shown by black barbs within the encircled regions. The system near 500W is Hurricane Fabian and the system further east is an ITCZ disturbance. Both systems had deep convection over the areas highlighted.

(Continued from page 17)

This is caused by attenuation (reduction) of the signal as it travels to and from the ocean surface, increased scattering by the raindrops, and increased sea surface roughness caused by raindrop splashing on the ocean surface. For light wind conditions, heavy rain causes an overestimate of the wind speed, due to increased backscatter from the raindrops and increased roughness caused by splashing on the ocean surface. Conversely, rain contamination has a lesser effect on wind speed estimates in stronger wind situations since, the increased sea surface roughness caused by the wind will dominate over the rain effect. There are no sensors on the Quikscat satellite that can directly measure rain. Thus, identifying rain-contaminated retrievals is problematic. However, the post-processing of the Quikscat data includes a "rain flag" which alerts forecasters that certain wind estimates may be contaminated based on characteristics of the wind estimates that suggests that rain may be present

These winds are often highly scrutinized by the forecaster or omitted altogether. Rain contamination can be a severe limitation especially for weather systems that cause deep convection such as tropical cyclones. An example from Hurricane Fabian (2003) is shown in Figure 5. Rain flagging ability should be improved with the new SeaWinds scatterometer on Midori 2 since that satellite is also equipped with the AMSR instrument which can more directly measure precipitation. The above limitations of scatterometers can significantly affect the accuracy of the data and may present misleading information. In some cases, extensive experience and analysis is required to properly interpret that data and to compensate for untimely data. For this reason, mariners should use caution when making crucial decisions based solely on scatterometer information. The National Weather Service's high seas and offshore forecasts incorporate forecaster interpretation of scatterometer data and other remotely sensed information as well as ship observations.

Acknowledgments

The author wishes to acknowledge the thoughtful comments by Dr. Richard Knabb, Dr. Chris Hennon, Christopher Burr, Robbie Berg, and Hugh Cobb which greatly aided in the composition of this paper.
This article makes use of information presented on the Jet Propulsion Laboratory webpage (www.jpl.nasa.gov).
For more information on the new Seawinds scatterometer on Midori 2, see http://winds.jpl.nasa.gov/news/index.html.

Biography

Jamie Rhome has worked as a meteorologist/forecaster for the Tropical Analysis and Forecast Branch of the Tropical Prediction Center since September 1999. He received his B.S. and M.S degrees in Meteorology from North Carolina State University. Previous work experience includes the United States Environmental Protection Agency and the State Climate Office of North Carolina at North Carolina State University.

References

Atlas, R., R.N. Hoffman, S.M. Leidner, J. Sienkiewicz, T.-W.Yu, S.C. Bloom, E. Brin, J. Ardizzone, J. Terry, D. Bungato, and J.C. Jusem, 2001: The effects of marine winds from scatterometer data on weather analysis and forecasting. Bulletin of the American Meteorological Society, Vol 82, No. 9, 1965-1990.

Cobb, H.D., D.P. Brown, and R. Molleda, 2003: The use of Quikscat imagery in the diagnosis and detection of Gulf of Tehuantepec wind events 1999-2002. Preprints 12th Conference on Satellite Meteorology and Oceanography. Long Beach, CA 9-13 Feb. 2003. PP 410.

Rhome, J.R., 2003: Application and use of volunteer observing ship (VOS) data at the Tropical Prediction Center/National Hurricane Center. Mariners Weather Log. Spring/Summer, 2003.

The Impact of QuikSCAT Winds on the Issuance of Marine Wind Warnings

Joan Ulrich Von Ahn,
STG/DSTI, Ocean Prediction Center,
National Centers for Environmental Prediction

Introduction

The primary responsibility of The Ocean Prediction Center (OPC) at the National Centers for Environmental Prediction (NCEP) is the issuance of marine warnings and forecasts for maritime users in order to foster the protection of life and property, safety at sea, and the enhancement of economic opportunity. The issuance of these warnings (Gale, Storm, Hurricane Force) is dependant on a good network of surface wind observations. Until recently, the primary sources of surface wind observations over the oceans have been ship reports through the Volunteer Observing Ship (VOS) program and data buoys. Since ships tend to avoid areas of inclement weather and the current network of data buoys is nowhere near optimal density there is quite a substantial data void over the open ocean. To fill this void, many attempts have been made to measure surface wind speed and direction using remote sensing instruments flown onboard satellites. The most recent has been the SeaWinds Scatterometer on the National Aeronautics and Space Administration (NASA) Quick Scatterometer Spacecraft (QuikSCAT) which was launched in June 1999. The instruments on QuikSCAT can acquire hundreds of times more observations of surface wind speed and direction each day than can ships and buoys combined. By providing continuous, high resolution measurements of both wind speed and direction, regardless of weather conditions, QuikSCAT has been able to fill in much of the data void over the oceans. The data was incorporated into the National Oceanic and Atmospheric Administration's (NOAA) operational global weather analysis and forecast systems model (GFS) in July 2001. Since October 2001 the forecasters at the OPC have had near real time access to this data right at their operational computer workstations, enabling them to use QuikSCAT winds in the forecast process. This inclusion has proven to be invaluable and has resulted in an increase in the number of wind warnings issued by the OPC. During the fall of 2002, a month long study was conducted to quantify this impact. After a brief description of the history and background of scatterometers, this article will describe the results of this study.

History of Scatterometers

During World War II it was noted that radar measurements over the oceans contained noise or Asea clutter. It wasn't until the 1960's that this noise was related to wind velocity. Scatterometers are microwave radar sensors that were developed to measure this type of backscattering from an aircraft or a satellite. Scatterometers were first flown in space on board the Skylab missions in 1973 and 1974. In 1978, the Seasat-A Satellite Scatterometer (SASS) was flown on the Seasat-A satellite. However, due to a malfunction the mission only lasted four months. The European Space Agency flew a Scatterometer (SCAT) onboard its European Remote Sensing Satellite-1 (ERS-1) in 1991. Data was gathered for an 8-year period but coverage was limited due to the design of the scatterometer. In 1998, The NASA Scatterometer (NSCAT) was launched onboard the Advanced Earth Observing Satellite (ADEOS-I) and provided 90% coverage of the ocean areas within a 2-day period until the satellite lost power in 1997. The Quick Scatterometer Satellite (QuikSCAT) carrying the SeaWinds Scatterometer was launched in 1998 to fill the gap created when NSCAT data was no longer available. QuikSCAT provides complete coverage of the world's ocean surface every two days. Due to the success of NSCAT and QuikSCAT another SeaWinds Scatterometer was launched on the ADEOS-II Satellite in December 2002.

How QuikSCAT Works

Scatterometers work on the basic principle that the roughness of the ocean surface is related to the speed and direction of the wind above that surface. The Scatterometer transmits radar pulses to the ocean surface. These pulses are then reflected (backscattered) from the ocean surface back to the satellite and converted to wind speed and direction by computer algorithms. QuikSCAT orbits the earth in a near polar (sun synchronous) orbit every 101 minutes at an altitude of 500 miles. The antenna rotates 18 times per minute measuring an 1800 km wide swath and alternates between transmitting and receiving pulses about 200 times per second. An automated analysis scheme calculates the speed and direction of the surface wind from the backscattered pulses. The accuracy of the measurements is 2 meters per second for wind speeds from 3 to 20 meters per second, while the wind direction is accurate to 20 degrees. Despite the vast coverage provided by QuikSCAT there are some limitations. Since QuikSCAT is in a near polar orbit data is not always available where and when it is needed. Furthermore due to contamination of the data from rain, the wind speed and direction may not always be accurate in areas of rainfall.

Date of Mission	Satellite	Instrument	Facts
1973-74	Skylab	❑ Simple scatterometer ❑ Single measu rements at one location at any given time	❑ First time scatterometers flown in space ❑ Wind direction had to be calculated from another source.
1978	Seasat-A	❑ Seasat-A Satellite Scatterometer (SASS) ❑ Ku-band scatterometer (14GHz) ❑ Four fanned beamed antennas ❑ 2 swaths (600Km each)	❑ Operational for 4 months until the spacecraft malfunctioned ❑ Proved that accurate wind speed and direction measurements could be made from space
1991	**European Space Agency Remote Sensing Satellite -1 (ERS-1)**	❑ **Scatterometer (SCAT)** ❑ **C-band (5 GHz)** ❑ **Single swath (500 km)**	❑ Provided the longest record of global scatterometer data yet obtained.
1996	**Advanced Earth Observing Satellite (ADEOS-I)**	❑ **NASA Scatterometer (NSCAT)** ❑ **Ku-band (14GHz)** ❑ **Two swaths, 600 km wide**	❑ Provided measurements of ocean surface winds in all weather and cloud conditions. ❑ Operated for 10 months until the solar panel failed. ❑ Obtained 190,000 measurements per day ❑ Mapped 90% earths oceans every 2 days.
1999	QuikScatterometer Satellite (QuikSCAT)	❑ SeaWinds scatterome ter ❑ Ku-band, (13.4GHz) ❑ Rotating dish antenna ❑ One swath, 1800 km wide	❑ Quick fix for the loss of NSCAT data ❑ 400,000 measurements in one day ❑ Provides measurements of ocean surface winds in all weather and cloud conditions. ❑ Maps 90% earth's oceans every 2 da ys.
2002	ADEOS-II	❑ SeaWinds scatterometer ❑ Ku-band, (13.4GHz) ❑ Rotating dish antenna ❑ One swath, 1800 km wide	❑ Will provide measurements of ocean surface winds in all weather and cloud conditions. ❑ Will map 90% earth's oceans every 2 days.

QuikSCAT winds in the Ocean Prediction Center

Description of OPC

The OPC is a part of the NCEP located at the NOAA Science Center in Camp Springs, MD. The OPC is operational 24hours per day, 7 days per week. The staff consists of 20 meteorologists along with small technical development and administrative branches. The primary responsibility of the OPCis the issuance of marine warnings, forecasts, and guidance in text and graphical format for maritime users for the protection of life and property, safety at sea, and the enhancement of economic opportunity. These products cover the North Pacific and North Atlantic Oceans on three scales: high seas, regional and offshore and are prepared and disseminated on a fixed, recurring schedule. The OPC also quality controls marine observations globally from ship, buoy, and automated marine observations for gross errors prior to being assimilated into computer model guidance.

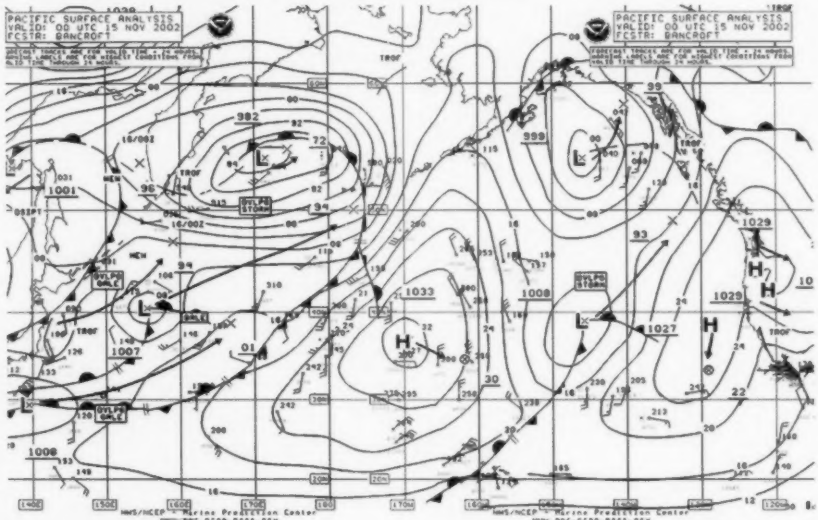
The Ocean Prediction Center Forecast Process

OPC produces the surface analyses for the North Pacific and North Atlantic Oceans four times each day at 00UTC, 06UTC, 12UTC, and 18UTC (see figure 1). These manually produced charts are prepared from a blend of objective and subjective methods. They depict surface features including isobars, the current and 24hr forecast positions of High and Low pressure centers, fronts and troughs and areas of gale, storm or hurricane force winds. To prepare the surface analysis, the OPC forecasters look at observational data from satellites, ships, buoys and other NCEP surface analyses using The National Centers - Advanced Weather Interactive Processing System's (N-AWIPS) workstations. When QuikSCAT data was made available on the workstations in 2001 they were able to access the near real-time surface winds over much of their forecast areas. Based on the wind fields from the GFS model, data buoys, ship observations and QuikSCAT wind data, the OPC forecaster determines where the areas of Gale, Storm and Hurricane Force winds are occurring and places the appropriate warning label on the surface analysis.

The Impact of QuikSCAT on the forecast process

During the late fall of 2002 a month long study was conducted to quantify the effects of QuikSCAT wind data on the issuance of marine warning labels on the surface analyses produced by OPB. Forecasters were provided shift logs and were asked to note when QuikSCAT winds were the deciding factor in the issuance or change of a warning label.

The data was collected for the Atlantic High Seas and the Pacific High Seas from 15 NOV 2002 thru 15 DEC 2002 for four forecast periods daily (00UTC, 06UTC, 12UTC, 18UTC) Forecasters were asked to document how many times they used QuikSCAT winds during their shift according to the following categories:



Gale (34 - 47 knots)
Storm (48 - 63 knots)
Hurricane (64 knots or greater)

Figure 1

Did they use QuikSCAT to: Upgrade to Gale, Upgrade to Storm, Upgrade to Hurricane Force, Downgrade from Gale, Downgrade from Storm, Downgrade from Hurricane Force, or Maintain current warning?

At the end of the test month the data was collected and entered into a spreadsheet for analysis. The total number of warning labels issued for each forecast area was tabulated. Then the total number of warning labels was further broken down by warning type (Gale, Storm, Hurricane Force.) This dataset was labeled The Number of Warning labels Issued With QuikSCAT Winds. Using the forecasters shift logs and the corresponding surface maps any warning labels that were issued using QuikSCAT Data were identified.

The warning label was then adjusted to simulate the warning decision that would have been made by the forecaster if he/she did not have access to the QuikSCAT. This second dataset was labeled The Number of Warnings Issued Without QuikSCAT Winds.

Example: ship observations indicate gale force winds while the QuikSCAT pass showed an area of storm force winds. The forecaster issued a storm force warning label. So for the dataset of warnings issued with QuikSCAT winds the warning label was counted as a storm force category. In this case if the forecaster did not have QuikSCAT winds available he would have issued a gale force warning label. So for the dataset of warnings issued without QuikSCAT winds the warning label was changed from storm force to gale and was counted as a gale label.

Results

When QuikSCAT winds were used the number of warning labels issued increased by 30% in the Atlantic and 22% in the Pacific.
(see **figure 2**)

In the Atlantic 397 warnings were issued using QuikSCAT winds while only 279 warnings would have been issued if QuikSCAT were not available. In the Pacific 519 warnings were issued with QuikSCAT while only 406 would have been issued without QuikSCAT.
(see **figure 3**)

The greater impact in the Atlantic was attributed to the difference in the distribution of the shipping routes in the Atlantic and Pacific.
(see **figure 4**)

In the North Pacific the shipping routes are more uniformly distributed throughout the area, while in the North Atlantic there is a definite void north of 55N.

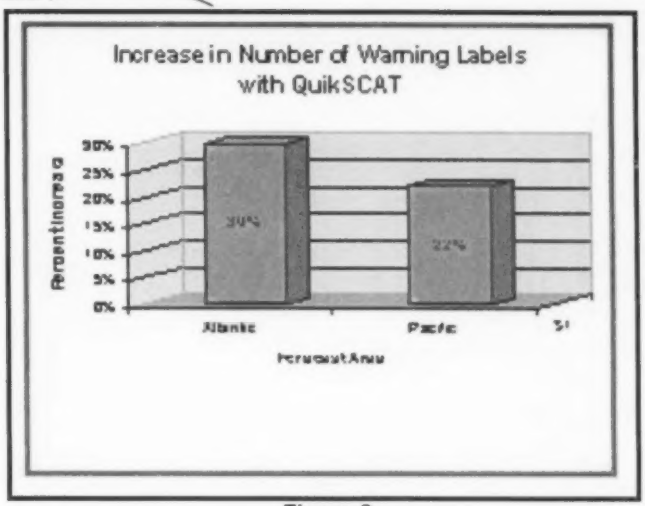


Figure 2

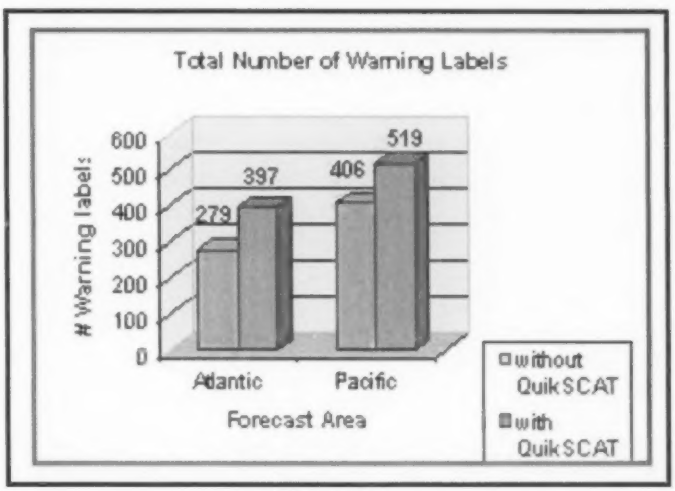


Figure 3

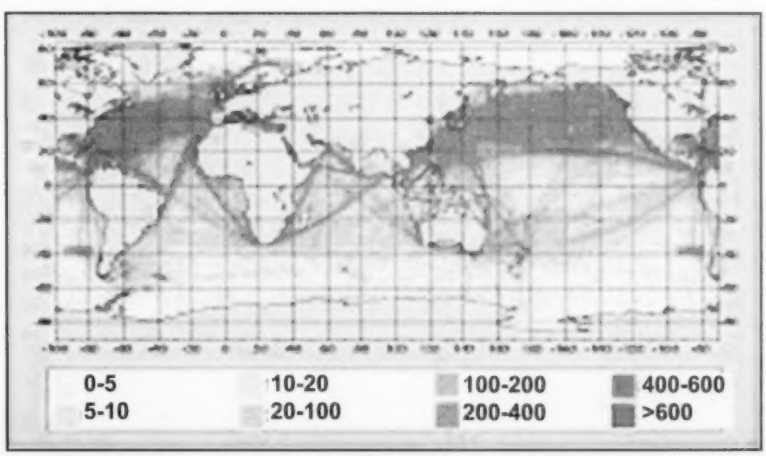


Figure 4

Results (continued)

When the data was analyzed according to warning type it was apparent that QuikSCAT had a greater impact with the more significant warning types (see **figures 5a, 5b**). The greatest impact was noted in the Pacific with a 42% increase in the issuance of Hurricane Force Warnings.

This information infers that prior to the availability of QuikSCAT winds many storm and hurricane force winds may have been missed since ship observations in those areas were lacking.

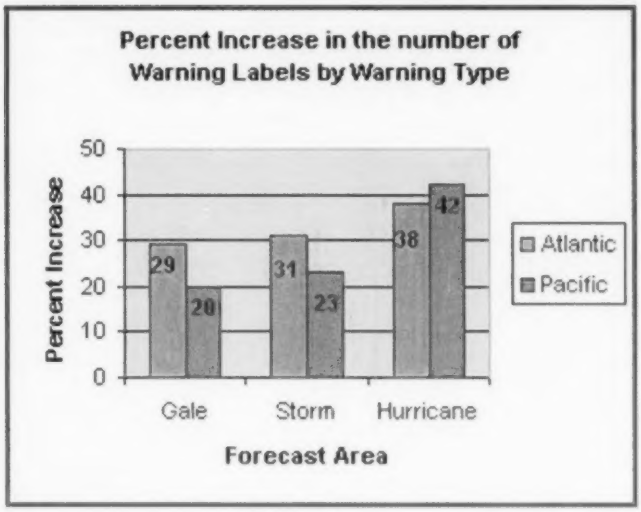


Figure 5A

Case Studies

Several examples were chosen to demonstrate the types of impact QuikSCAT had on the forecaster's warning decision.

The first 3 examples demonstrate how QuikSCAT was used to upgrade storm intensity.

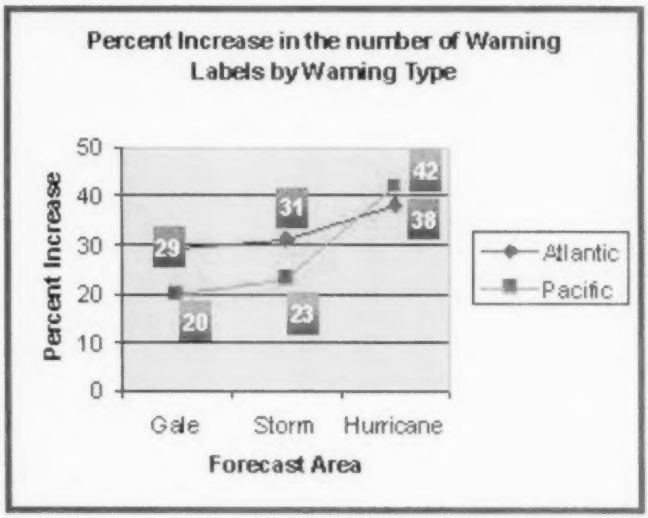
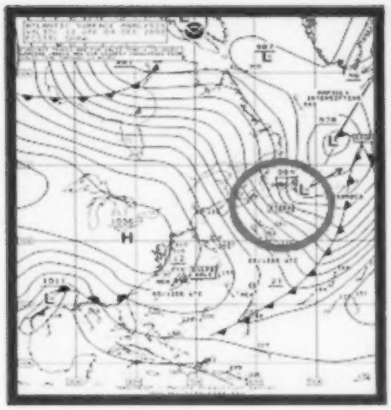


Figure 5B



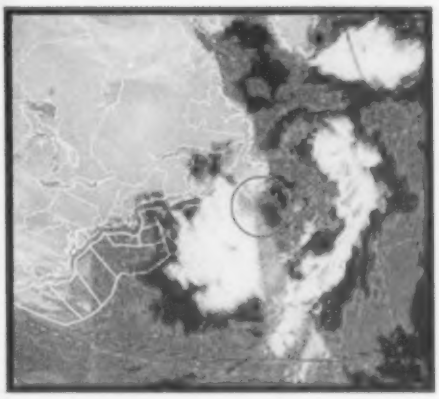
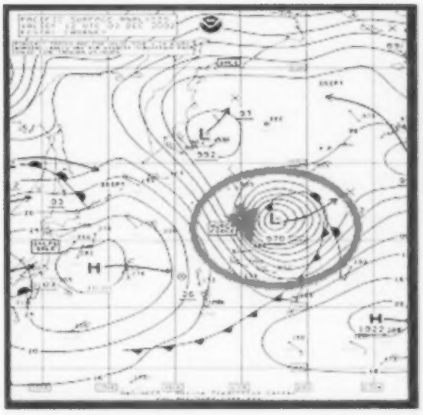


Figure 6A & 6B

In the first example, the forecaster analyzed a low-pressure center of 984hPa at 46N 52W on the surface analysis for 04 Dec 2002 12UTC(see **figure 6a & 6b**)

Ships in the vicinity of the low all reported observations of 35KT. or less indicating a Gale label. The QuikSCAT pass from 0945UTC clearly shows an area of storm force winds around the Low south of Newfoundland. The data was not rain-flagged so the forecaster upgraded his warning label one category to Storm Force.



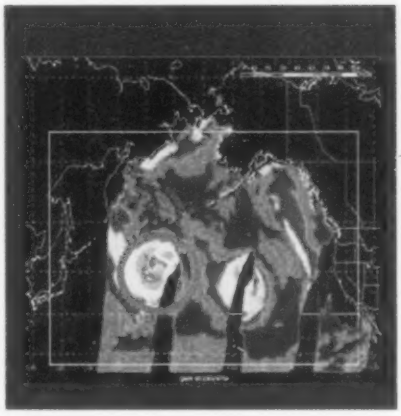
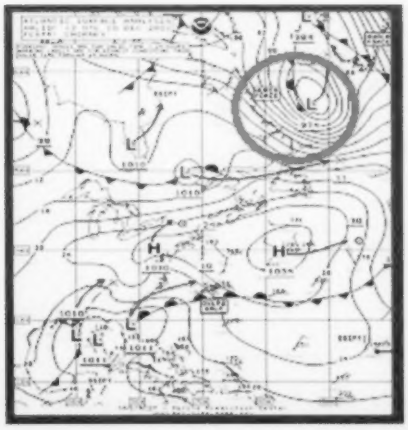


Figure 7A & 7B

In example 2, (**figure 7a & 7b**) 974hPa Low was centered at 56N 52W 10Dec 2002 at12UTC. Very few ship reports were available and they all had observations of 40KT. or less, indicating Gale conditions. Based on this information alone, the forecaster would have put a gale label on the surface analysis. The QuikSCAT pass from 10Dec 2002 1045UTC depicted an area of Hurricane force winds. Although the winds were rain-flagged the data did not appear to be contaminated so the forecaster upgraded his warning label two categories to Hurricane Force.



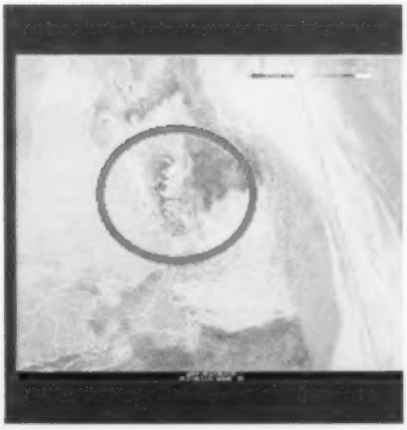


Figure 8A & 8B

The third (**figure 8a & 8b**) example was another of upgrading from Gale to Hurricane Force. Low pressure in the Pacific Ocean 12UTC Dec 3 2002 was located at 43N 175E with a central pressure of 970hPA. Ship observations were all 40kt. or less except for one 60KT report. The forecaster would not have placed a Hurricane Force warning with this low based on only one report-a Gale label would have been placed. The QuikSCAT pass from 0750UTC indicated an area of Hurricane force winds in the vicinity of this ship report. Based on this the forecaster upgraded 2 categories to Hurricane Force.

The last example (**figure 9a & 9b**) illustrates how QuikSCAT was used to downgrade a storm's intensity. At 00UTC 15NOV 2002 a 982hPa low was analyzed at 54N 172E. Ship reports were all 35KT. or less except for one report indicating 50kt. Based on this observation the forecaster would have issued a storm force label. The QuikSCAT pass from 14NOV 2002 1930UTC showed a large area of gale force winds, with no evidence of any 50kt winds. The forecaster downgraded the label from storm force to Developing Storm/Gale.

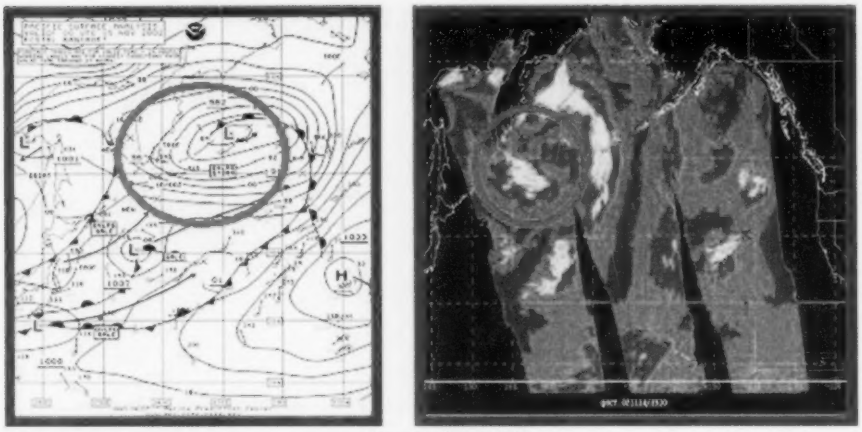


Figure 9A & 9B

Conclusion

The results from this study are very encouraging. The safety and economic implications of these findings are extremely important. For the first time we can quantify the positive and significant impact that QuikSCAT winds have on the analysis and forecast process. Not only were more warnings issued, but the most significant impact occurred with the Storm and Hurricane Force Warnings. In two of the above case studies the forecaster was able to accurately raise his warning label 2 categories from Gale to Hurricane Force. Prior to the availability of QuikSCAT winds forecasters were not able to identify Hurricane Force Extratropical cyclones. With QuikSCAT surface wind observations they can now identity the location and the magnitude of these powerful storms. The resulting surface analyses produced by OPC have never been more accurate.

A second study has just been completed for the period 15May - 15June 2003. Preliminary results show once again that the number of warnings issued by the OPC increased when QuikSCAT winds were used, with the greatest increase noted in the North Atlantic. In both the first and second study, the forecasters noted two limitations to the use of QuikSCAT winds. The first involved data coverage. Because the satellite flies in a sun-synchronous polar orbit, data is only available 2 times daily for each location on the surface of the Ocean. Therefore data is not always available in the vicinity of a particular storm system; many times a critical area falls within a data gap. The second limitation involves the rain-flagged data. Not all rain-flagged data is contaminated and it should be evaluated before it is ignored. In order to accomplish this it is necessary to be familiar with the signatures of contaminated data and not all forecasters have received adequate training. Despite these limitations QuikSCAT winds are a valuable tool for the Marine forecaster. These issues will be partially addressed when the study is repeated for the period 15OCT 2003 - 15NOV 2003. The wind data from the SeaWinds Scatterometer on ADEOSII will be included, thus increasing the frequency and the area of coverage. Prior to the study, the forecasters will be given a tutorial in the use of rain-flagged data so that they will be able to to decipher which data is indeed contaminated. It is expected that an even greater impact will be seen.

About the Author:

Joan Ulrich Von Ahn holds a BS and MS degree in both meteorology and oceanography. She was employed as a meteorologist in the National Weather Service for 18 years. Von Ahn worked in the Aviation Weather Branch and in the Office of Meteorology- most notably as an on-air meteorologist on the public television program AM Weather. After a brief stint as a back up TV meteorologist at WRC-TV in Washington, DC, Von Ahn returned to the National Weather Service as a contractor in the Ocean Prediction Center, to work on verifying the impact of QuikSCAT winds on the forecast and analysis process.

Voyage on the Robert Seamans (a first-timers perspective)

Mark H. Strobin, Lead Forecaster
Marine Focal Point / Weather Forecast Office, Monterey, CA

The **Robert Seamans** a 134.5 ft Brigantine sailing vessel owned by the Woods Hole Oceanographic Institute, photos by the author.

I had never been on a boat before, not even a sailboat. But, there I was, on the deck of the **Robert Seamans**, a 134.5 ft Brigantine sailing vessel owned by the Woods Hole Institute in MA, wondering if I was ever going to get my sea legs...trying to get used to that "patch" behind my ear, and nervous as could be. An "Ocean Navigator's" Course was being offered for people who own, or who where about to own yachts. This course was taught on the **Robert Seamans** from August 8, 2003 to August 13, 2003. The vessel was sailing from Pier 27 in San Francisco to San Pedro (Long Beach), CA. The weather was beautiful during the voyage. There was not a trace of fog during the whole journey. The moon was nearly full and the ocean glittering like diamonds in the light. There were 30 "souls" on board, including students, crew and two National Weather Service (NWS) meteorologists. The other meteorologist was Lee Chesnau from the Ocean Prediction Center in Camp Springs, MD). Students had come from around the U.S., even from as far away as West Virginia. The many subjects to be covered included using GPS, knots, navigation, radar, dead reckoning using stars (such as Arcturus), off-shore marine meteorology, and coastal marine meteorology. Raising the sails was manual, and definately hard work. Each day during the voyage there were classes in meteorology, in addition to a regular briefing with the Captain. I taught the crew how to take various observations and input the data in to the AMVER/SEAS Voluntary Observing Ship Program.

On August 8th we set sail at 4 pm sharp from Pier 27. We anchored the first night 1/2NM from Sausalito. Music could be heard from shore...the saying so close, yet so far was appropriate for the situation. We sailed passed Alcatrez on a 26 kt wind blowing through the Golden Gate. Remarkedly, I felt fine...no hint of seasickness. I was up to 1:30a.m. on deck talking to the Captain about marine meteorology. The sleeping arrangements were tight, especially for someone 6'4". However, the food was incredible; I must have gained 10 pounds during the five days. On August 9th, we motored out under the Golden Gate Bridge. We couldn't sail because the tide was flooding in at more than 3 KT. After passing under the Golden Gate we went through the "Potato Patch", a rough patch of water that is part of the convergence zone at the entrance of the Golden Gate. We continued 60NM offshore. It was a bit of a lonely feeling watching the Golden Gate Bridge turning into a speck...and disappearing. Again, no seasickness - so I got brave (or foolish!!) And took off the "patch".

On this day we broke up into watches, I was part of Watch C2. My role, in addition to standing watch and teaching the crew observations was to teach coastal meteorology and to brief the Captain. A word about the Captain...he was interested in more than the "forecast". He wanted to completely understand the hows and why of everything. Another word about the Captain...if Hollywood was going to script someone to be a Captain in the movies...Captain Steve Tarrant would be it. He was a spitting image of George Clooney from "The Perfect Storm". He was singing old sailing songs...all he was missing was an eye-patch and a parrot (or maybe a deck cannon or two).

The voyage itself was pretty uneventful. I saw several whales...most likely grey whales. One Great White shark was circling the boat near Catalina Island. We also sailed to the offshore anchored buoy near Point Conception (buoy 46023). We went through two pods of dolphins...it was amazing how graceful they were. It looked as though they were playing with the ship. The big excitement occurred on the night of August 10th. We were about 100NM west of Point Conception. A low-level jet developed. The winds along Point Sur were 50 KT sustained at 100 feet AGL. The ship recorded 38 KT sustained...Gale Force. The seas were 10-15ft...with some combined seas 20ft. I was standing watch, strapped in, at the bow between 9pm-130a.m. The seas were washing over the deck. We had to change the main sail to a Storm sail....not an easy task to do manually in those winds and seas. It was an exciting time for all.

Explorer of the Seas Assists In Hurricane Tracking

Data on Hurricane Claudette Came From Only Cruise Ship With Science Labs

Miami - July 21, 2003 - **EXPLORER OF THE SEAS**, the world's only cruise ship equipped with state-of-the-art ocean and atmospheric science laboratories, continues to make important contributions of meteorological data to assist the National Hurricane Center.

The 142,000-ton Royal Caribbean International ship recently provided the NHC with valuable 15-minute updates of surface winds on Hurricane Claudette as it grew from a tropical storm. The data was mentioned by NHC as a factor in locating the center of Claudette as it interacted with the Yucatan Peninsula.

In readings taken east of Cozumel early on July 11, **Explorer of the Seas** recorded 50-knot surface winds when reconnaissance planes were unable to get a more reliable indicator that flight-level winds of 40 knots. During the 2001 and 2002 hurricane seasons, data from **Explorer of the Seas** was used in forecasting for Hurricane Michelle and Hurricane Isidore.

Royal Caribbean's innovative, oceangoing research labs are operated by the University of Miami's Rosenstiel School of Marine and Atmospheric Science, which has provided permanent technicians on two-week rotations. The labs, directed by Dr. Otis Brown, Dean of the Rosenstiel School, have been collecting data since the maiden voyage of **Explorer of the Seas** October 28, 2000. Each weekly voyage adds invaluable information on the variability of strong currents like the Gulf Stream, the distribution of chlorophyll, and seasonal changes in wind patterns and cloud cover that contribute to changing climate, and measurements that contribute to greater accuracy in satellite imagery.

"The data set is the longest and most extensive continuous shipboard measurements available in the Caribbean Sea," says Liz Williams, program manager for the Rosenstiel labs. "These labs monitor the ocean and atmosphere as the ship cruises through the Caribbean at an average of 20 knots," she explains, "and provide more than 400 reports a month to the National Oceanic and Atmospheric administration, which is more than any other vessel in the U.S. Voluntary Observing Ship (VOS) program."

VOS was organized for obtaining weather and oceanographic observations from moving ships, and some 1,600 vessels transmit data to the National Weather Service. Never is a Royal Caribbean ship in harm's way because wind fields of tropical storms are typically very large. Because there is always a lab technician aboard **Explorer of the Seas**, the data quality is constantly monitored.

A research lab is operated by the University of Miami's Rosenstiel School of Marine and Atmospheric Science aboard the ***Explorer of the Seas***, a Royal Caribbean International ship, that provides more than 400 reports a month to the National Oceanic and Atmospheric administration, which is more than any other vessel in the U.S. Voluntary Observing Ship (VOS) program.

The ocean lab provides scientists with data on sea surface temperature, salinity, chlorophyll, and ocean currents under the ship to 1,000 meters below the hull. This year, a new instrument has measured PCO 2, which is important in predicting the ability of the oceans to absorb carbon dioxide, a gas associated with global warming.

The atmospheric lab provides a weekly view of the winds, cloud cover, precipitation and particle counts, which, at times, includes data on the African dust clouds that travel across the Atlantic to Florida.

In addition to research activities on **Explorer of the Seas**, each week a scientist is available to give tours of the labs and a lecture on current research in their field. Laboratory space can be made available to any scientist interested in marine or atmospheric studies in the Caribbean.

Royal Caribbean International is a global cruise brand currently with 16 ships in service and three more under construction.

Storm Force winds, heavy seas batter the Western Cape Coast

Ian Hunter -
South Afican Weather Service

Photo at right comes courtesy of the Anton de Lange of Cape Town Radio. It shows the '**Sealand Express**' aground off Sunset Beach, Milnerton. Surf conditions would have been considerably worse on the more exposed beaches south of Greenpoint.

A series of intense frontal vortices affected the South-Western Cape on 18 & 19 August. The passage of the initial cold front at approximately 2p.m. on Monday was associated with average winds of over 50 KT in Table Bay, gusting to over 70 KT at times. On the Beaufort wind scale this translates to Force 10 - i.e. 'Storm Force' winds. These winds resulted in considerable damage in parts of the Greater Cape Town area.

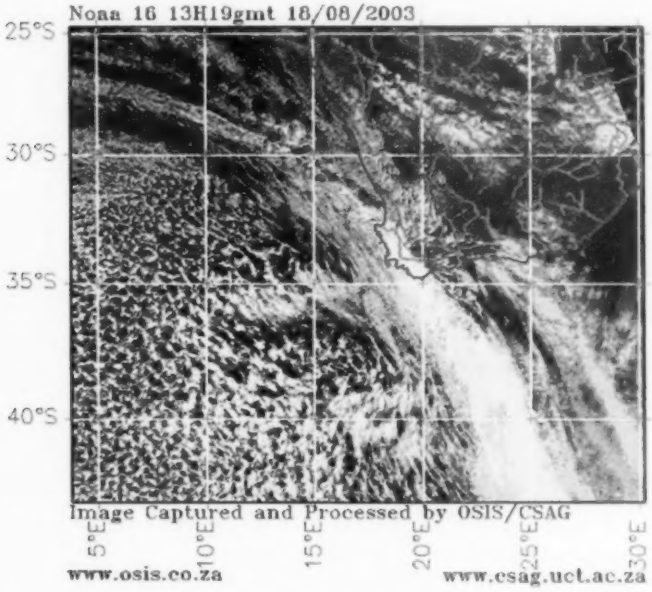


Photo above is courtesy of OSIS in Cape Town, a visible image from the NOAA 16 satellite taken soon after the front passed over Cape Town. The thickening in the frontal band west of Cape Agulhas identifies a frontal wave or secondary vortex. This was one of the main reasons for the extreme wind speeds.

Air pressure dropped to just under a 1000 hPa rising sharply to the rear of the front (this was a long way off any new record - the May 1984 storm produced a barometric pressure of 984 hPa.)

Regular wave data is supplied to the South African Weather Service courtesy of CSIR, NPA and NAMDEB : the significant wave height at CSIR's directional Waverider buoy off Slangkop rose to 8.23m at 2p.mm on 19 August (individual waves of over 12m were recorded).

The casualty with the highest profile was without doubt the container vessel '**Sealand Express**' which ran aground at 6.30 a.m. on 19 August. In actual fact the winds had dropped considerably by this time but unusually strong currents may well have been present in Table Bay as a result of the heavy swell. Fortunately the swell direction had swung to the south-west which meant that although the long-period swell was still refracted into the eastern parts of the Bay, its energy was considerably reduced. (This in contrast to the exposed position of the '**Ikan Tanda**' which ran aground off Scarborough in September 2001)

TRANSPACIFIC

by Skip Gillham

Photograph courtesy of Al Sykes

In May 18, 1971, the **Transpacific** got caught by the treacherous shoals around the French Islands of St. Pierre and Miquelon in the Gulf of St.Lawrence. The West German freighter joined other ships that made these waters their final resting place. The 398 foot, 9 inch long Cargo carrier had been built at Lubeck, Germany, in 1954 and started trading to the Great Lakes when the St.Lawrence Seaway opened in 1959.
The ship, shown in a photo from the collection of Al Sykes, had been inland every year from 1959 until the time of her loss.

Transpacific was outbound with 11passengers and a varied cargo of general freight, aluminum and logs when problems developed with the radar installation and Decca Navigator. The Captain radioed St. Pierre and requested that a technician be brought out when his ship reached the harbor anchorage.

Although heavy fog surrounded St. Pierre, local fishermen were at work when the**Transpacific** sliced though the fog, past their dories and bound for the shoals off Ile Aux Marines. Efforts to overtake**Transpacific** and warn of the impending disaster failed and the ship piled on the rocks of the deserted island that acts as a breakwall for St. Pierre harbor. The efforts of salvage tugs failed and a final, farewell dinner was held aboard ship before the engines were shut down and the vessel abandoned.

During the first night close to 70 island dories visited the ship as cargo, furnishings and provisions were lowered over the side and carried off. The French Government, fearing pollution, stated an oil spill would not be tolerated. The Captain returned the next day in an effort to restart the engine and pump off the fuel but the looters saw him coming and would not let him on board until their work was done. Eventually officials decided to burn off the oil and it blazed and
smoldered for 61 hours. Meanwhile on the island, some homes were equipped with juke boxes for entertainment while others had riding lawn mowers for their sand swept lots.

Lawsuits and legal battles followed while the relentless forces of the waves pounded the ship into many pieces.

How to Obtain Moored Buoy Reports While At Sea

David Gilhousen
National Data Buoy Center

Tim Rulon
National Weather Service

Arguably, a buoy is just a speck on the great big sea. However, thousands of mariners access their observations each month, along with the forecasts,to help them make critical safety decisions. With this in mind, we've created several new ways to obtain the latest observations.

Vessels that have can send an e-mail, but have no World Wide Web capability, can e-mail a series of commands to obtain a single observation. This capability, called FTPmail, is the same one used to obtain NWS marine forecasts.

What's new is that NDBC has created small files that contain just the latest information for each station.

Here's the commands that you would use to obtain the observations from buoy station 41001:

open www.ndbc.noaa.gov
cd /data/latest_obs
get 41001.txt
quit

For more information on how to use FTPmail and the other NWS marine products that are available, see

http://weather.noaa.gov/pub/fax /ftpmail.txt.

Closer to shore, mariners that have Personal Digital Assistants (PDA's) can obtain the same information via the wireless web. The URL to obtain this is:

http://www.ndbc.noaa.gov/ mini_station_page.phtml

Type the station identifier in the box followed by enter to see the latest observation.

Again, these are small, text-only files, with limited line length.

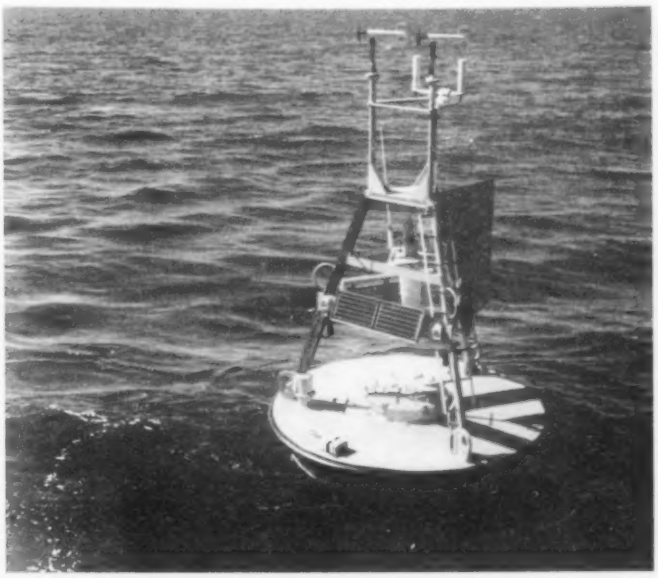
Finally, NDBC's voice response system, Dial-A-Buoy, now reads all moored buoys and coastal stations shown on NDBC's web site,

http://www.ndbc.noaa.gov.

This includes Canadian and European buoys as well as university-maintained buoys or stations.

If you haven't been to NDBC's web site in several years, check again. The number and coverage of buoys is increasing.

Instructions on how to use Dial-A-Buoy are located at **http://www.ndbc.noaa.gov/dial.shtml .**



MARINE WEATHER REVIEW - North Atlantic Area

March to August 2003

By George P. Bancroft

Introduction

The period from March through the first half of April was quite active with left-over winter storms frequent, originating near the U.S. East Coast and tracking east-northeast, with many turning north toward the Greenland area and becoming storms. All of the hurricane-force storms of the six-month period occurred during this period. The level of activity dropped off sharply late in April and beyond.

The month of May produced only two lows with storm-force winds, one near Greenland early in the month and another, described in this article, developing well south of Newfoundland. There was one storm in June, at the beginning of the month near the U.S. East Coast.

The tropical season was off to an early start, as the first tropical storm of 2003, Ana, formed in late April and affected OPC's far southern waters, well before the official June 1 start of the Atlantic hurricane season. Other tropical systems, a hurricane and a depression, appeared in OPC's area in July, with the really busy part of the season yet to come.

Tropical Activity

Tropical Storm Ana: Ana originated from a non-tropical low which drifted north into OPC's waters, southwest of Bermuda, early on April 18. At the same time, strong high pressure developed to the north near the Canadian Maritimes, with a large area of east to northeast gales developing between the low and the high by that time. The strongest wind report was as 45KT east-northeast wind from the ship SFIR near 38N 64W at 0000 UTC April 19. The ship ELZZ9 (42N 53W) encountered northeast winds of 40KT and 7.0-meter seas (23 feet) at 1200 UTC April 21.The low center moved northwest to 34N 69W on the 19th before looping back to the southeast and remaining over warm water. The Tropical Prediction Center (TPC) declared the system subtropical as it moved out of OPC's area of marine responsibility and named it "Ana", the first named cyclone of 2003.

TPC names both subtropical and tropical cyclones when they develop maximum sustained winds of 34KT or more. Figure 1 shows newly-named Subtropical Storm Ana passing south of 31N with the positionand intensity based on the advisory time (0900 UTC). The cyclone name, position, intensity and motion are given in the box placed near the cyclone in Figure 1. The system became a tropical storm south of 31N in TPC's area about a day later, before turning back into OPC's marine area on April 23.

This was the first named tropical storm to occur in the Atlantic basin in April (Reference 1). The second part of Figure 1 shows Ana as a tropical storm with position and other information (in box) based on the 0300 UTC April 24 advisory.

The system became extratropical as it merged with the stationary front nearby within six hours. The cyclone then drifted east and later northeast before accelerating northeast and redeveloping as a gale over Great Britain with a 983-hPa central pressure at 1200 UTC April 27. The system weakened over Norway on the 30th.

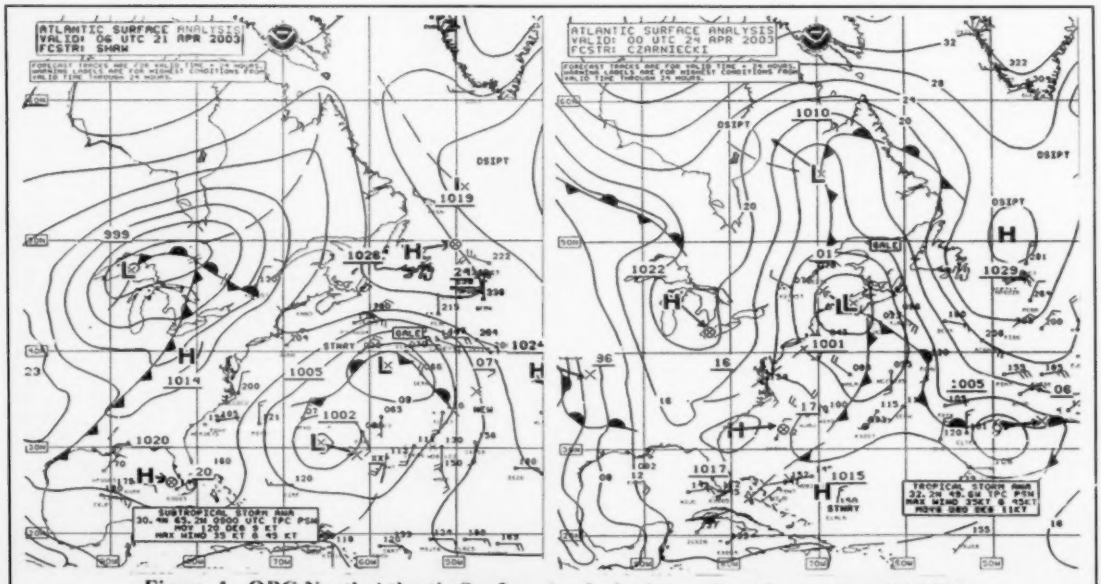


Figure 1. OPC North Atlantic Surface Analysis charts (Part 2 – west) valid 0600 UTC April 21 and 0000 UTC April 24, 2003. A named cyclone, Ana, is depicted as a subtropical storm in the first chart and as a tropical storm in the second chart.

Hurricane Danny: Danny, the first hurricane of the 2003 Atlantic hurricane season to affect OPC's waters, originated as Tropical Depression 5 which actually formed outside the tropics in OPC's marine area of responsibility, near 32N 54W, at 1500 UTC July 16. The cyclone moved initially northwest and then curved around the subtropical high centered near 36N 40W while intensifying into a minimal hurricane with maximum sustained winds of 65KT with gusts to 80KT (Figure 2). Figure 2 shows Danny six hours after attaining hurricane strength. Danny then moved into cooler water and weakened to a tropical storm while turning east on the north side of the subtropical high early on the 20th. The cyclone then weakened to a tropical depression while turning southeast at 2100 UTC July 20. Danny subsequently weakened further and became trapped as a remnant low in the broad subtropical ridge about 700 nm southwest of the Azores, before finally dissipating by the 27th.

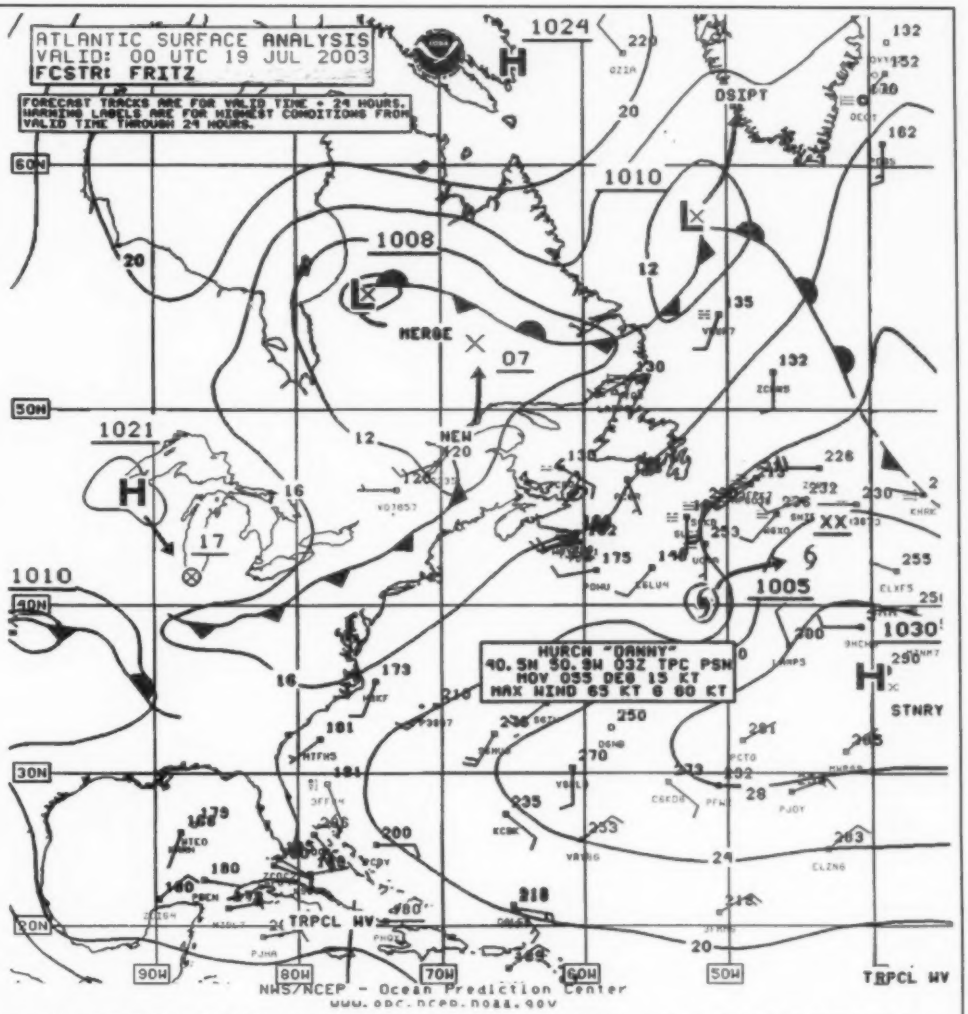

ATLANTIC SURFACE ANALYSIS
VALID: 00 UTC 19 JUL 2003
FCSTR: FRITZ
FORECAST TRACKS ARE FOR VALID TIME + 24 HOURS.
WARNING LABELS ARE FOR HIGHEST CONDITIONS FROM VALID TIME THROUGH 24 HOURS.
HURCN "DANNY"
40.5N 50.9W 03Z TPC PSN
MOV 035 DEG 15 KT
MAX WIND 65 KT G 80 KT
HERGE
NEW
STNRY
TRPCL HV
NWS/NCEP - Ocean Prediction Center

Figure 2. OPC North Atlantic Surface Analysis chart (Part 2) valid 0000 UTC July 19, 2003, showing Hurricane Danny at maximum intensity.

Tropical Depression 7: This tropical cyclone had a brief existence over water, forming off the north Florida coast on the afternoon of July 25 and moving northwest, before moving inland over Georgia and the Carolinas on the morning of July 26. Buoy 41004 (32.5N 79.1W) reported a peak wind of southwest 29KT at 1400 UTC July 26 after passage of the cyclone. Buoy 41008 (31.4N 80.9W) reported a peak wind of 27 KT from the east at 0300 UTC July 26 and maximum seas of only 2.0 meters (7 feet) two hours later.

Other Significant Events of the Period

South-Central North Atlantic Storm, March 1-3: The busy month of March began with a low which, after moving off the coast of the Carolinas late on February 27, developed hurricane-force winds at a relatively far-south location late on March 1 while tracking east-northeast just south of 40N.

The low is shown near maximum intensity in Figure 3 as a rather compact hurricane-force storm, with the ship **C6OL1** plotted southwest of the center near 36N 45W with a 65KT northwest wind. The **Chesapeake Bay (WMLH)** encountered north winds of 60KT and 11.5-meter seas (37 feet) near 40N 46W at this time. Twelve hours prior, the ship **SCFH** near 36N 52W reported a northwest wind of 70 kt. The vessel **KRPD** reported 15-meter seas (49 feet) near 39N 59W a bit earlier, at 1200 UTC on the 1st, although the author is uncertain of the accuracy of the report. Another ship, **PDHW** near 37N 34W, also encountered 11.5-meter seas (37 feet), along with southwest winds of 45KT, at 1200 UTC March 2. The system maintained hurricane-force winds until early on the 3rd, before weakening to a gale-force low near France early on March 4, and then merging with a low south of Iceland on the 5th.

Intense North Atlantic Storm, March 6-9: Strong high pressure developed behind the departing hurricane-force low above, forcing two following storms on more northward and then northeastward tracks, with the second system becoming absorbed by a much more intense storm late on March 7. The period of most rapid development of this powerful storm is shown in Figure 4. This low emerged off the mid-Atlantic coast of the U.S. as a 1001-hPa low at 1800 UTC March 6 and is shown passing south of Newfoundland twelve hours later (first part of Figure 4), about to absorb the preceding storm system east of Newfoundland (970-hPa). In the twenty-four hour period ending at 1200 UTC March 8, the central pressure dropped a remarkable 55-hPa (1.62 inches), or more than 2-hPa per hour. The system is shown at maximum intensity at 1800 UTC March 8 (second part of Figure 4) with a pressure of 924-hPa (27.29 inches). A search for intense North Atlantic lows in prior issues of Mariners Weather Log done in September 2002 for research turned up a 916-hPa low near the Faeroe Islands on January 11, 1993 as apparently the last low that was deeper than this one (Reference 2).

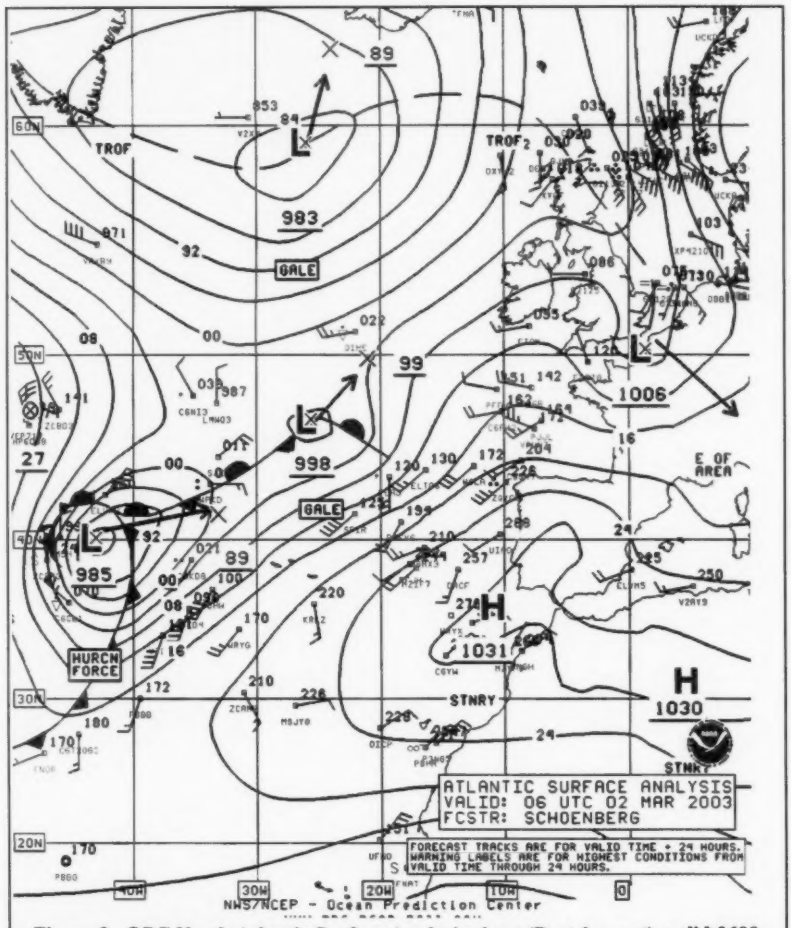


Figure 3. OPC North Atlantic Surface Analysis chart (Part 1 – east), valid 0600 UTC March 2, 2003.

Figure 5 is a 500-hPa analysis for 1200 UTC March 7, when the low was beginning its period of rapid intensification, reveals a strong upper-level low over northeast Canada, a strong jet stream to the south and its associated short-wave trough supporting development.

More information on use of the 500-hPa chart by mariners can be found in Reference 3. A list of ship reports with hurricane-force winds and/or seas 40 ft or higher (greater than 12 meters) from this storm may be found below.

SHIP	LOCATION	DATE/TIME (UTC)	WIND (kt)	SEAS (m/ft)
DPLE	43N 43W	7/1800	W 65	14.5/ 47
SKWI	50N 39W	8/0600	S 70	
SKWI	50N 39W	8/1200	W 80	
C6QE7	48N 46W	8/1200	NW 65	
PIBO	44N 38W	8/1200	W 55	17/ 56
Sea-Land Florida (KRHX)	42N 41W	8/1200	W 45	14.5/ 47
DPLE	43N 44W	8/1800	NW 50	14.5/ 47
SKWI	49N 40W	9/0600	W 70	
Sea-Land Florida	45N 33W	9/1200	W 40	13.5/ 44

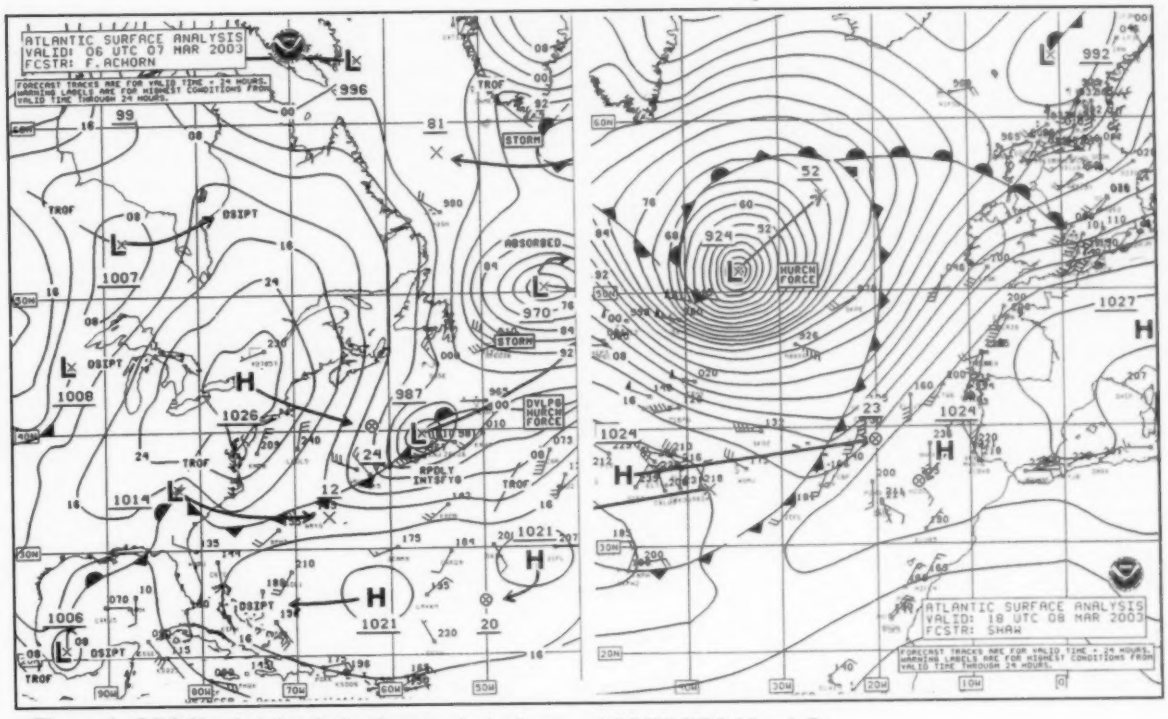


Figure 4. OPC North Atlantic Surface Analysis charts valid 0600 UTC March 7 (Part 2) and 1800 UTC March 8 (Part 1), 2003.

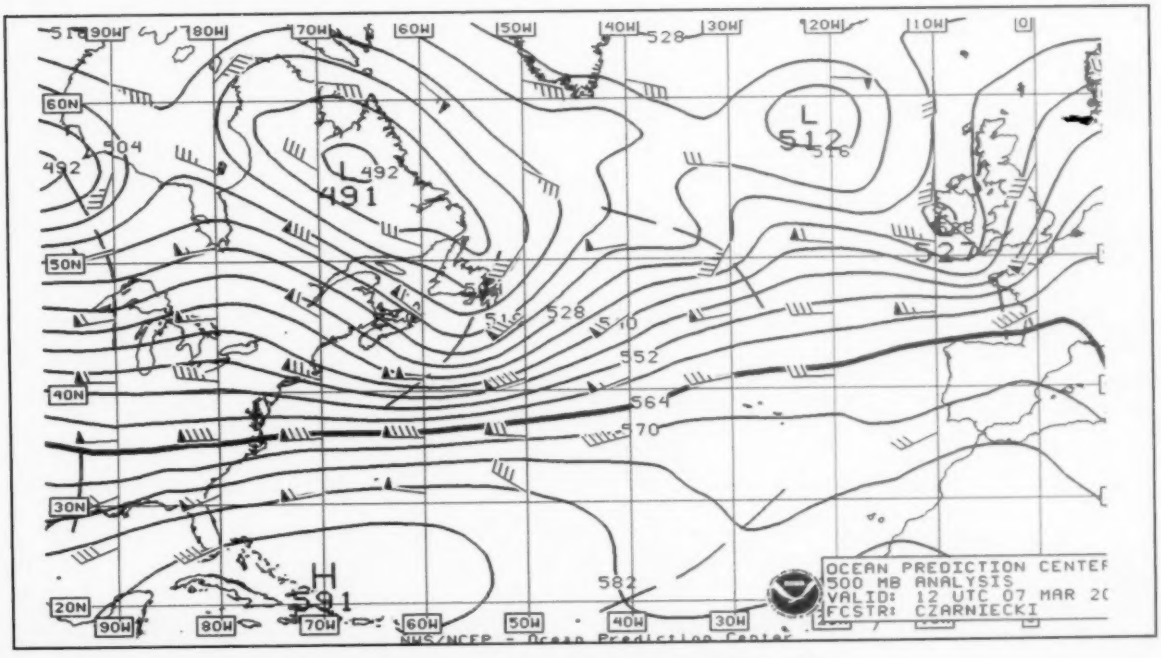
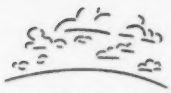


Figure 5. OPC 500-Mb analysis of North Atlantic valid at 1200 UTC March 7, 2003. The valid time is 6 hours later than that of the first surface analysis of Figure 4. The broken or dashed lines are short-wave troughs.

The QuikScat image of satellite-sensed winds valid just prior to the storm's reaching maximum intensity (Figure 6) reveals a broad swath of winds in the 65 to 80KT range from south to w of the center. This data supports the 80KT west wind reported by **SKWI** and listed above, taking into account the time difference and movement of the center. Figure 7 is a visible satellite image of the storm taken less than five hours prior to the valid time of the second surface analysis in Figure 4, near maximum intensity. The well-defined frontal cloud bands spiral around a center that appears to be surrounded by multiple cloud rings, common in very intense systems. The storm maintained hurricane-force winds until 1800 UTC March 9 while slowly weakening and moving east-northeast. The low then weakened to a gale northwest of the British Isles on the 10th before moving into Norway late on the 11th.

Northwest Atlantic Storm of March 14-16: This low developed after moving off the mid-Atlantic coast of the U.S. late on March 13 then passed just east of Newfoundland late on the 14th before turning north toward the Greenland area, one of a series to take a similar track in March and early April. The center dropped 36-hPa in central pressure in the 24-hour period ending at 0600 UTC March 15. Figure 8 covers thirty-six hours of development of this low into a hurricane-force storm from its origin over the eastern U.S. The system moved into an area of sparse ship data, but the QuikScat data in Figure 9 reveal storm-force winds around the south and west semicircles of the center with one 65KT wind barb southwest of the center. The ship **PDHW** near 46N 44W reported south winds of 45KT and 10-meter seas (32 feet) at 0000 UTC March 15, while Platform VEP717 near the Grand Banks reported southwest winds of 55KT. The storm center attained a lowest pressure of 962 mb near 56N 48W at 0000 UTC March 16 before weakening west of Greenland on the 17th.



North Atlantic Storm of March 18-21: This system developed off the mid-Atlantic coast early on March 17 and followed a track similar to that of the previous storm except farther east after passing Newfoundland. Figure 10 depicts the development of this storm to maximum intensity over a 48-hour period. The second part of Figure 10 shows the system stalling east of Greenland. The 952-hPa central pressure made this system the second deepest of the North Atlantic in this period. A QuikScat image (Figure 11) taken about nine hours prior to the valid time of the second part of Figure 10 reveals a northeast flow of up to 75KT channeled between the occluded front and the Greenland coast, in an area where ship reports are rare. The storm subsequently weakened to a gale late on March 21 and then moved northwest of Iceland on the 23rd.

Eastern North Atlantic Storm, April 11-13: During the second week in April a series of weak lows tracked east off the U.S. coast, moving near 40N, until early on April 11 when the last in the series rapidly intensified and developed hurricane-force winds relatively far south, like the early March storm except farther east. Figure 12 shows a 1006-hPa frontal wave of low pressure well south of Greenland intensifying into a 968-hPa hurricane-force storm over a 30-hour period ending at 0600 UTC April 12. This developing low definitely qualifies as a meteorological "bomb", as the central pressure dropped 30-hPa in a 24-hour period ending at 0000 UTC April 12. The ship **PDAY** near 40N 27W reported southwest winds of 55KT at 0600 UTC April 12. Six hours later, the vessel **DEBB** encountered northwest winds of 35 kt but seas of 12 meters (40 feet) near 40N 37W. Although the system began to weaken thereafter, at 1800 UTC on the 13th the ships **WMBK** (34N 14W) and **PEBP** (45N 17W) reported west winds of 30 kt and 12-meter seas (40 feet), and northwest winds of 40KT accompanied by 12-meter seas (39 feet), respectively. The system then elongated upon encountering high pressure to the east, with one gale center dissipating near Spain on the 15th and another center moving north past Iceland on the 14th.

Cutoff Storm in South Central North Atlantic, May 22-23: A low-pressure center moved north into OPC's waters near 54W with a central pressure of 1004 hPa at 1800 UTC on the 21st and became a storm six hours later as it drifted northeast. The system stalled near 34N 51W early on the 22nd. Although the central pressure was only as low as 995-hPa, the cyclone encountered high pressure to the north and developed a tight pressure gradient and strongest winds around the north semicircle. At 1800 UTC on May 23, the ship **PDHU** (40N 54W) encountered north winds of 45KT and 10.5-meter seas (34 feet). The **Barrington Island** (C6QK) reported southeast winds of 40KT and 10-meter seas (32 feet) near 41N 47W at 0600 UTC May 24. The low began to move north-northeast on the 23rd, reaching 47N 35W at 0000 UTC May 26, when the buoy 44615 (47.5N 39W) reported a north wind of 50 KT. The center then weakened and passed east of Iceland on the 28th.

East Coast Storm of June 1-2: Inland low pressure at the start of the month redeveloped as a rapidly intensifying low off the North Carolina coast at 0600 UTC June 1, and dropped 16 mb in central pressure in the following twelve hours (Figure 13). This rapid rate of intensification and the resulting 974-hPa storm center near Cape Cod were quite unseasonable for June, more typical in the winter months. Figure 14 is an infrared satellite image of the storm, revealing a large fully-developed occluded system with a well-defined center near Cape Cod. The ship **SFIR** reported south winds of 50KT and 7-meter seas (23 feet) near 38N 63W at this time. Twelve hours later, the ship **A8BZ6** reported west winds of 60KT near 41N 65W. At 1200 UTC June 2, the vessel **ELUX6** (39N 56W) experienced seas of 8 meters (27 feet) along with southwest winds of 35KT. The buoy 44005 in the Gulf of Maine reported winds reaching 35KT with gusts to 54KT from the north-northeast at 1900 UTC June 1, the strongest report from a buoy. The Canadian buoy 44142 (42.5N 64.0W) reported maximum seas of 5.5 meters (18 feet) at 0800 UTC June 2. The storm then moved over the Canadian Maritimes and weakened, before turning more southeast and dissipating off Newfoundland on the 5th.

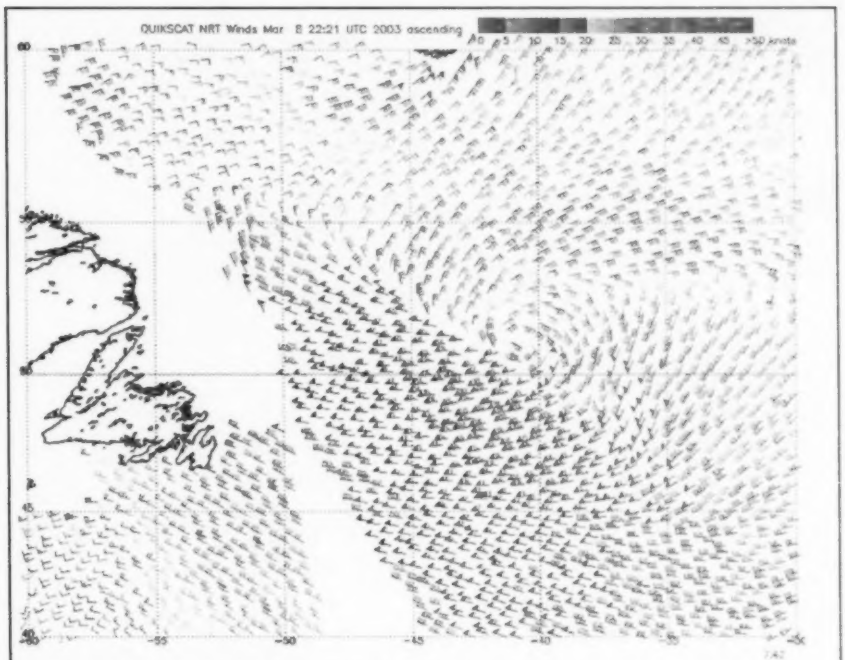


Figure 6. QuikScat scatterometer image of satellite-sensed winds valid at 0742 UTC March 8, 2003. Image is courtesy of NOAA/NESDIS/Office of Research and Applications.

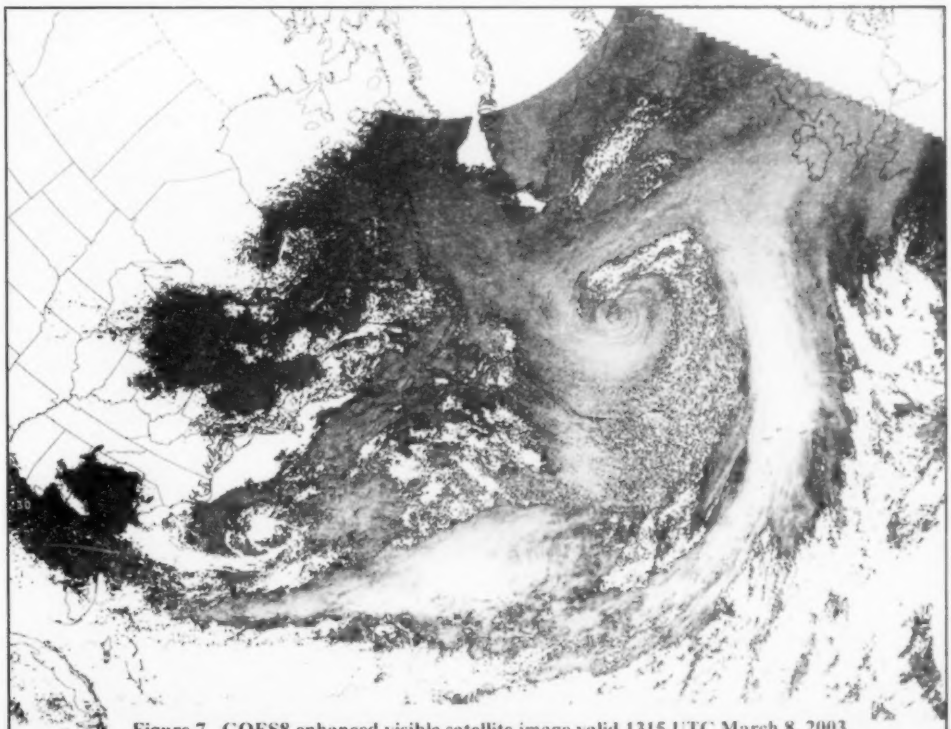


Figure 7. GOES8 enhanced visible satellite image valid 1315 UTC March 8, 2003. Clouds appear as shades of gray while cloud-free areas appear white.

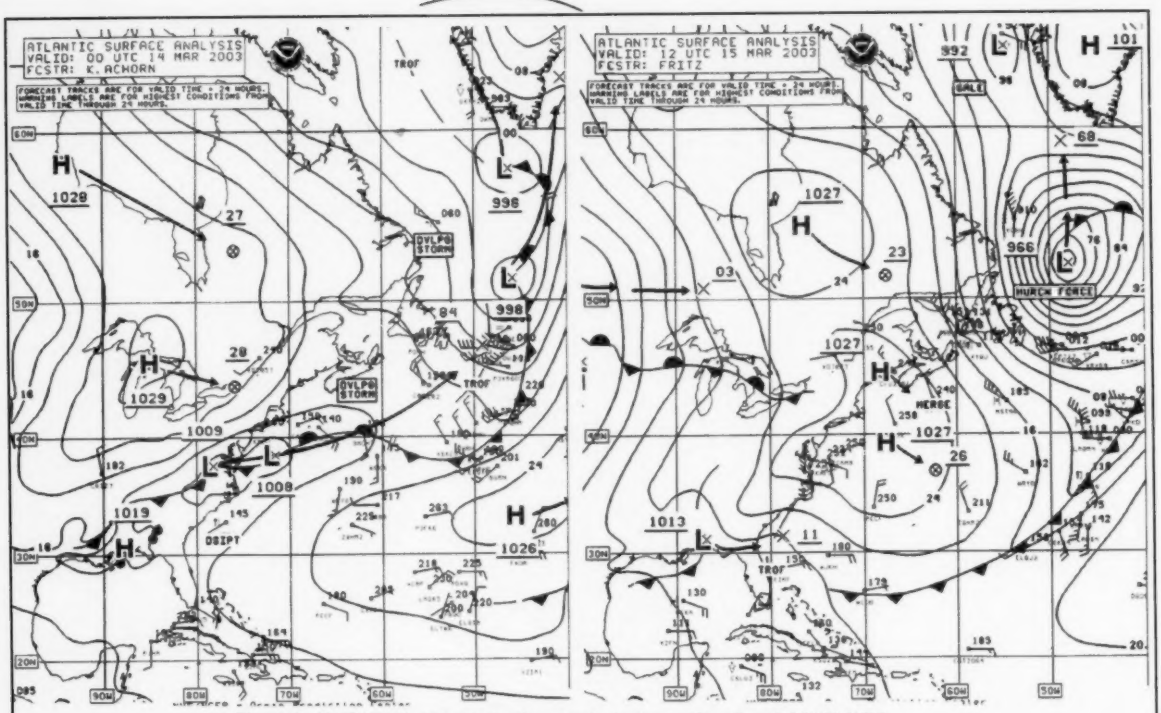


Figure 8. OPC North Atlantic Surface Analysis charts (Part 2) valid 0000 UTC March 14 and 1200 UTC March 15, 2003.

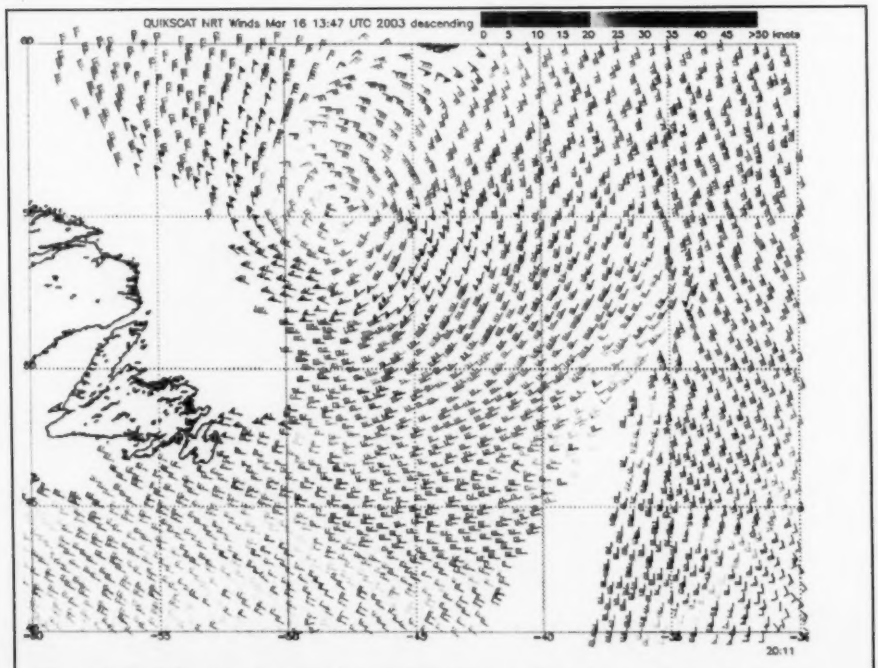


Figure 9. QuikScat scatterometer image of satellite-sensed winds valid at 2011 UTC March 15, 2003. Image is courtesy of NOAA/NESDIS/Office of Research and Applications.

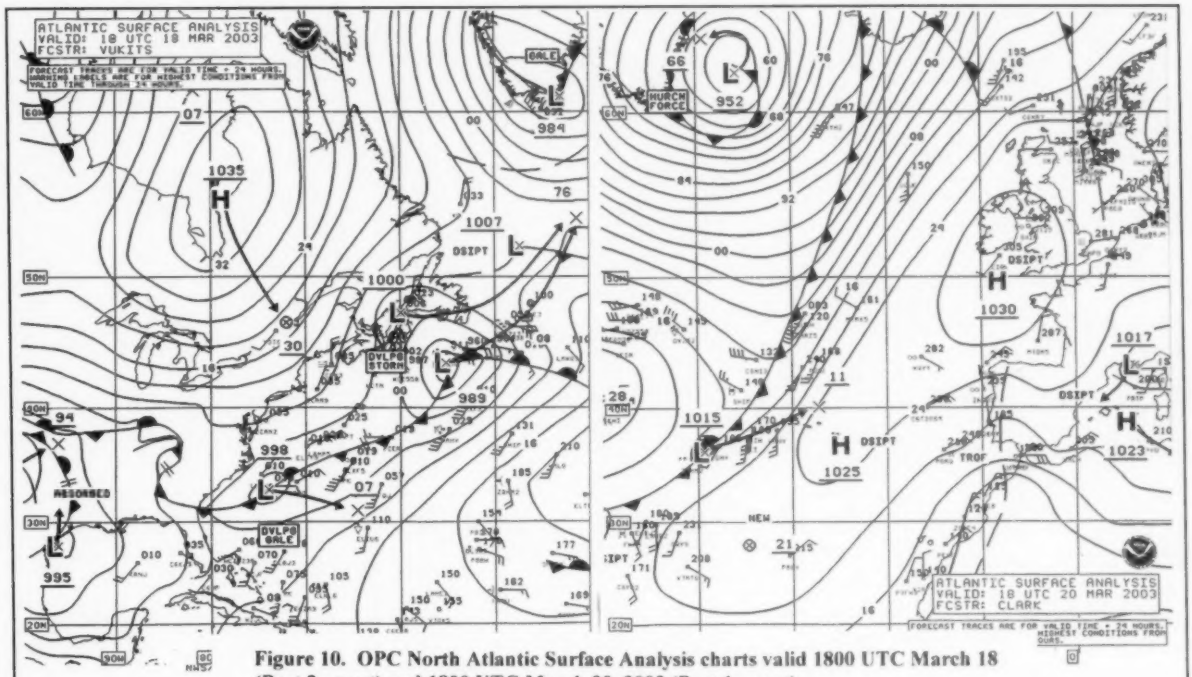


Figure 10. OPC North Atlantic Surface Analysis charts valid 1800 UTC March 18 (Part 2 - west) and 1800 UTC March 20, 2003 (Part 1 – east).

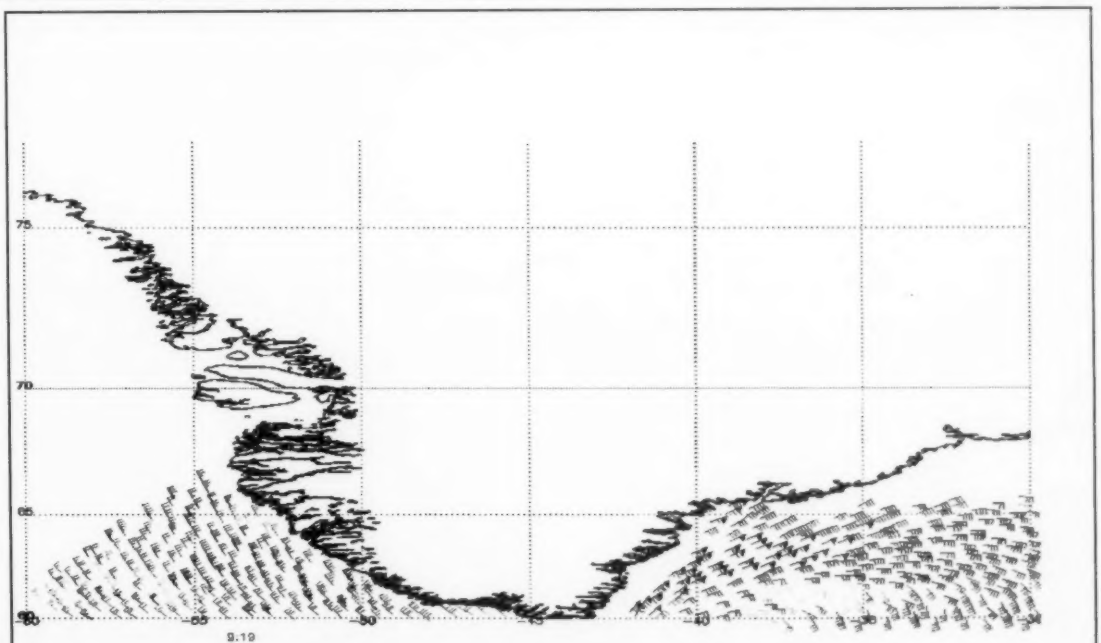


Figure 11. QuikScat scatterometer image of satellite-sensed winds valid at 0919 UTC March 20, 2003. Image is courtesy of NOAA/NESDIS/Office of Research and Applications.

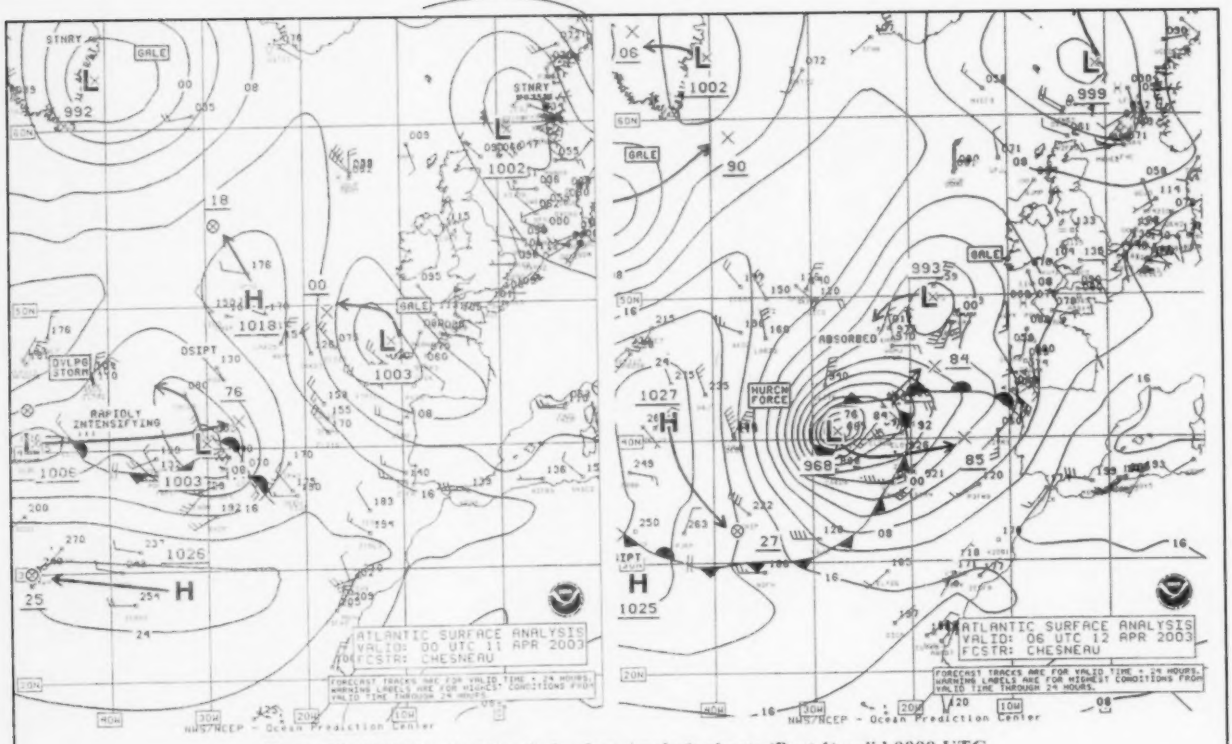


Figure 12. OPC North Atlantic Surface Analysis charts (Part 1) valid 0000 UTC April 11 and 0600 UTC April 12, 2003.

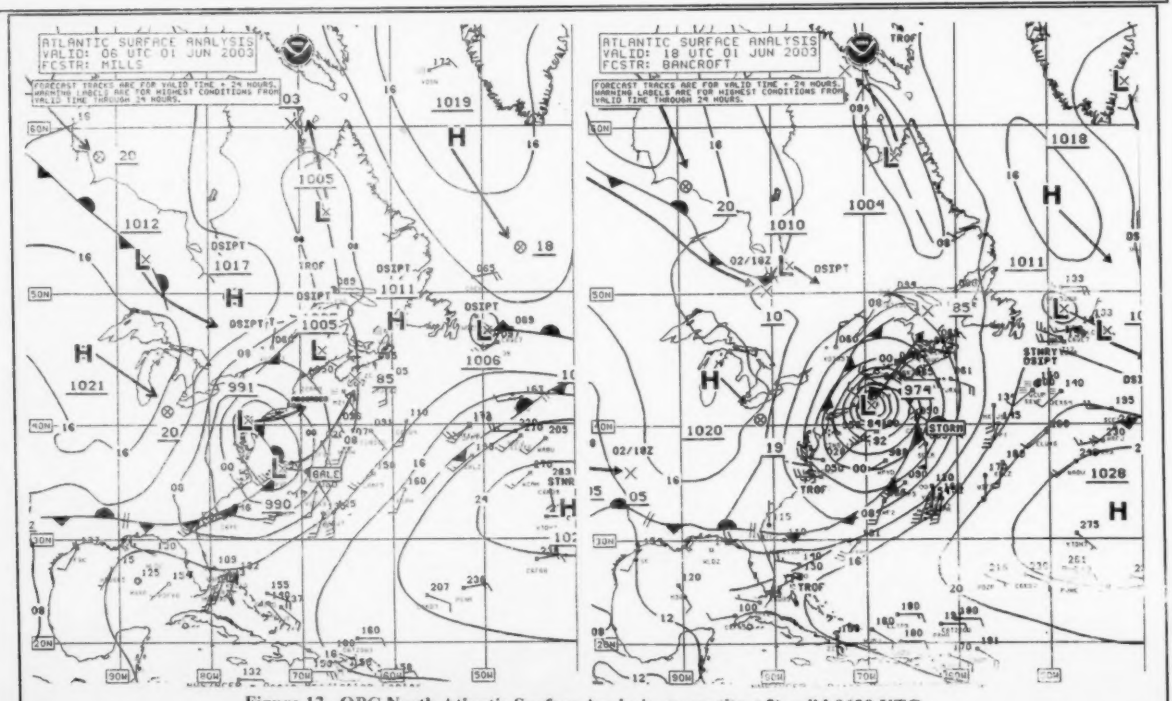


Figure 13. OPC North Atlantic Surface Analysis charts (Part 2) valid 0600 UTC and 1800 UTC June 1, 2003.

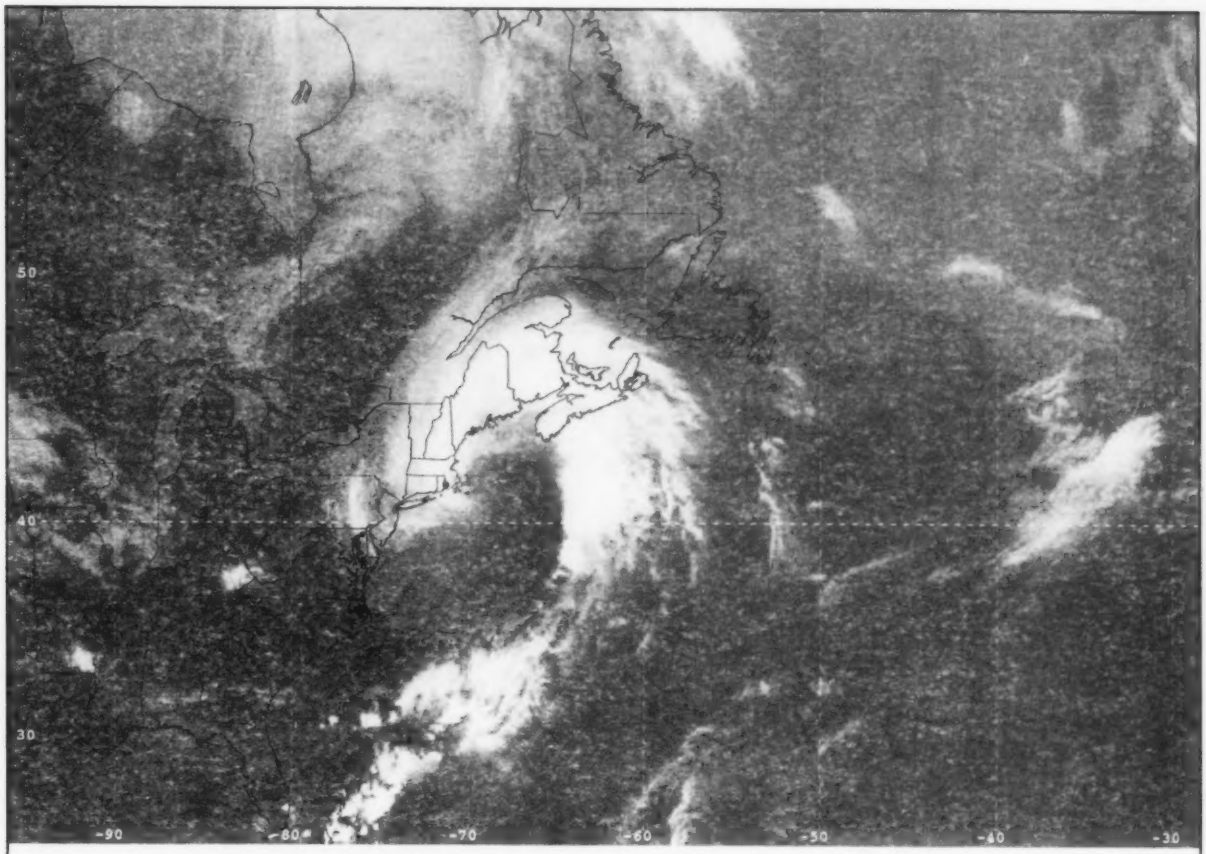


Figure 14. GOES9 infrared satellite image valid 1802 UTC June 1, 2003. Satellite senses temperature on a scale ranging from black (warm) to white (cold) in this type of image.

MARINE WEATHER REVIEW - North Pacific Area

March to August 2003

By George P. Bancroft

Introduction

The weather of the period was most active in March with some variability due to occasional blocking high pressure over the eastern Pacific and over the eastern Bering Sea. Most of the lows tracked northeast off Japan with some turning north toward the Kamchatka Peninsula while others proceeded east-northeast across the Pacific toward the Gulf of Alaska. There were a few that became trapped under blocking high pressure and stalled or moved in from south of 30N as cutoff lows. There were fewer lows producing hurricane-force winds than in the North Atlantic, with all occurring west of 170W. In OPC's high seas area east of 160E and north of 30N there were two brief hurricane-force events in March and April with another event approaching hurricane-force off the U.S. West Coast in Mid-March. There were three western North Pacific tropical cyclones, two of which quickly became extratropical upon reaching the area of Japan in June and August and the other actually moving into the southwest high seas waters of OPC in May.

Tropical Activity

Typhoon Etau: Etau approached Japan from the southwest as a weakening typhoon early on August 8, and then moved over Japan near 35N 136E with maximum sustained winds of 65KT with gusts to 80KT at 0000 UTC August 9. At this time the **Essen Express** (DHEE) reported southwest winds of 45KT near 34N 137E. The cyclone weakened to a tropical storm six hours later, before becoming an extratropical gale near 41N 144E at 1800 UTC August 9. The system then re-intensified into a storm with a central pressure of 978-hPa (Figure 1) at 0600 UTC August 10 after absorbing the low north of the Kurile Islands (first part of Figure 1).

The Salvia Ace (3FIQ7) near 47N 153E reported south winds of 50KT at that time. This was the only report of storm-force winds in an extratropical low during the June-to-August period. The cyclone then moved to the west of the Kamchatka Peninsula and weakened, with a new center forming to the east in the Bering Sea by the 11th and tracking east into Alaska on the 13th.

Tropical Storm Soudelor: Soudelor crossed the southern Sea of Japan on June 19 and became an extratropical gale near 40N 138E at 0000 UTC June 20. The **Arctic Sun** (ELQB8) near 36N 143E reported southwest winds of 40 kt six hours later. The center moved east to 39N 162E by 1200 UTC on the 23rd before becoming blocked by a ridge to the north, and then turning west and weakening.

Typhoon Chan-Hom and Subsequent Extratropical Development: This typhoon appeared on OPC's oceanic surface charts early on May 23 near 16N 151E with maximum sustained winds of 115KT with gusts to 140KT, and maintained this intensity while moving northeast to 23N 155E at 0000 UTC May 25. Chan-Hom then began to weaken, becoming a tropical storm upon reaching the southwest corner of OPC's high seas area near 30N 160E at 0600 UTC May 25 with maximum sustained winds of 55 KT with gusts to 70KT. Meanwhile, a non-tropical low formed on a front to the north of Chan-Hom near 40N by this time. By 0000 UTC May 27 this low moved northeast to 45N 180 while Tropical Storm Chan-Hom approached the front, about to become extratropical six hours later (Figure 2). Figure 3 is an infrared satellite image taken six hours prior to the valid time of Figure 2, showing Chan-Hom still rather distinct near 32N 164E and approaching the frontal cloud band. Chan-Hom subsequently weakened as an extratropical low but may have contributed to the development of the low to the north (992-hPa) in Figure 2 by feeding tropical moisture into the developing storm prior to this.

The northern low deepened by 22-hPa in the following twenty-four hours to become the 970-hPa storm in the second part of Figure 2, unseasonably strong for late May. Buoy 46072 (52N 172.1W) reported sustained north winds of 39KT and 5.0-meter seas (16 feet) at 2000 UTC May 27, a peak wind of 52KT one hour later, and maximum seas of 7.5 meters (25 feet) at 0500 UTC May 28. The **Hatsu Eagle** (ZNZH6) reported northeast winds of 40KT near 54N 171W at 0000 UTC May 28. At 0600 UTC May 28 the ship **3ETX6** (53N 158W) encountered east winds of 44KT. Six hours later the vessel 3FEY7 (46N 168W) reported northwest winds of 45KT and 10-meter seas (32 feet), the highest seas reported in this storm. A QuikScat image of the storm (Figure 4) reveals 50KT winds on the southwest side of the center. The system then slowly weakened while moving slowly east-southeast, before turning northeast into the Gulf of Alaska as weak low by the end of the month.

Other Significant Events

Western North Pacific Storm, March 7-9: This system was perhaps the most significant of the period in terms of generated winds and seas, forming relatively far south and affecting a high-traffic area. Figure 5 depicts the developing storm coming from south of Japan by 0000 UTC March 7, and then deepening to 974-hPa in thirty-six hours. The maximum intensity of 972-hPa was reached six hours later near 40N 150E. Some ship observations in this storm are given on page 43.

The storm system subsequently moved east-northeast and slowly weakened, becoming a large multi-centered gale in the central North Pacific on the 11th with the circulation covering much of the North Pacific on OPC's oceanic analysis area. This system would later redevelop near the west coast of the U.S. and Canada as described on the following page.

SHIP	POSITION	DATE/TIME(UTC)	WIND	SEAS(m/ft)
Chastine Maersk (OZZB2)	34N 147E	7/1200	SE 60	
APL Korea (WCX8883)	39N 149E	7/1800	SE 50	13.0/42
APL Korea	39N 145E	8/0000	SE 60	11.0/36
APL Thailand (WCX8882)	37N 146E	8/0600	W 55	10.5/35
Marie Maersk (OULL2)	42N 151E	8/1200	E 65	10.5/35
APL Korea	41N 155E	8/1200	ESE 60	11.5/38
President Adams (WRYW)	43N 147E	8/1800	N 50	13.0/42
President Jackson (WRYC)	37N 152E	9/1200	NW 50	15.0/49

Eastern North Pacific Storms, March 12-16: The complex central Pacific system mentioned above redeveloped eastward to a new center near 46N 146W (974 mb) at 0600 UTC March 12 and deepened rapidly to 954 mb twelve hours later while tracking northeast, to reach a maximum intensity of 953 mb off Southeast Alaska at 1200 UTC March 13 (Figure 6, first part). This was the most intense low of the six-month period in the North Pacific, in terms of central pressure, with a broad circulation covering much of the eastern North Pacific.

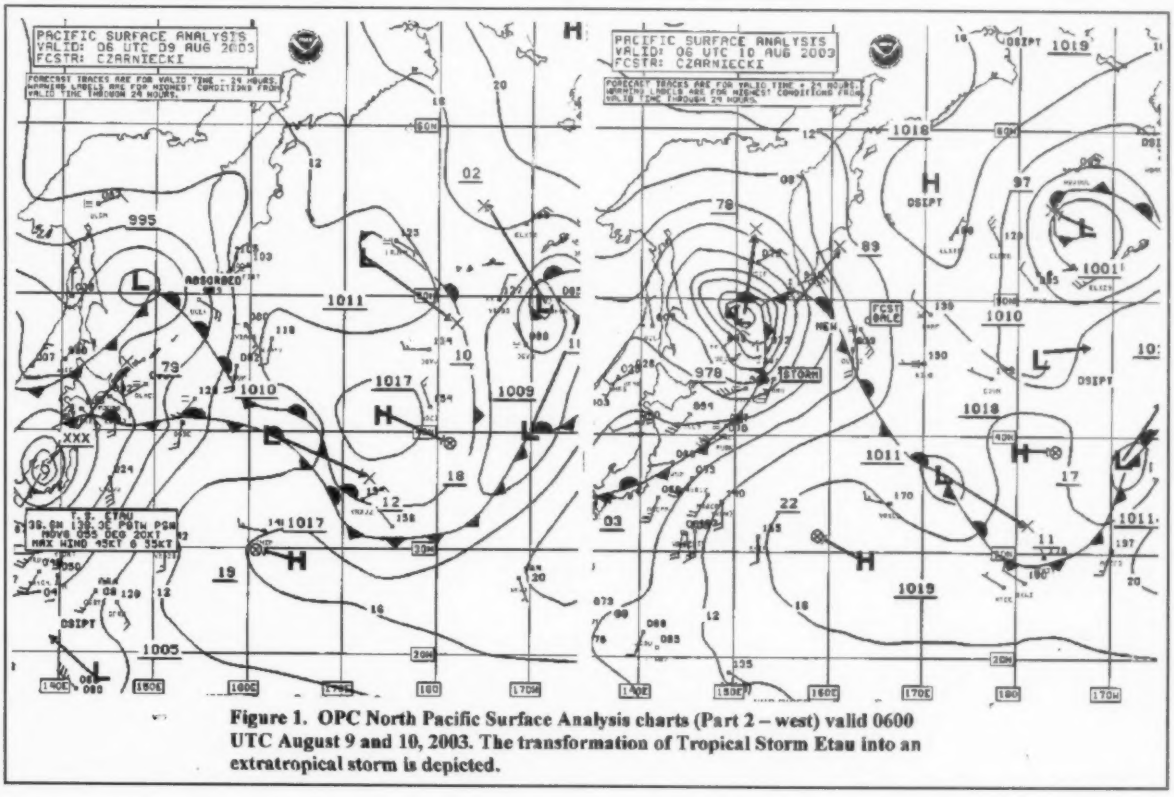


Figure 1. OPC North Pacific Surface Analysis charts (Part 2 – west) valid 0600 UTC August 9 and 10, 2003. The transformation of Tropical Storm Etau into an extratropical storm is depicted.

Twelve hours prior to the valid time of the first part of Figure 6, the **Sea-Land Patriot** (KHRF) reported north winds of 45KT and 10.5-meter seas (35 feet) near 50N 148W, while to the east the **Westwood Borg** (LAON4) encountered south winds of 35KT and 9.0-meter seas (29 feet) near 51N 134W. By 1200 UTC March 13 the stronger winds with this storm became concentrated near the coast ahead of the approaching cold front (Figure 6). The **Horizon Tacoma** (KGTY) reported a south wind of 60KT at 1800 UTC March 13. Buoy 46015 (42.7N 124.8W) had south winds of 45KT with gusts to 56KTat 0900 UTC March 13, and maximum seas 8.5 meters (28 feet) six hours later. To the north, Buoy 46050 (44.6N 124.5W) reported south winds of 41KT with gusts to 56KT and maximum seas of 10.0 meters (33 feet) at 1300 UTC March 13. Among C/MAN stations, Tatoosh Island reported the strongest wind, south 53KT with gusts to 69KT, at 1700 UTC March 13, and a peak gust of 70KT. (continued on page 45)

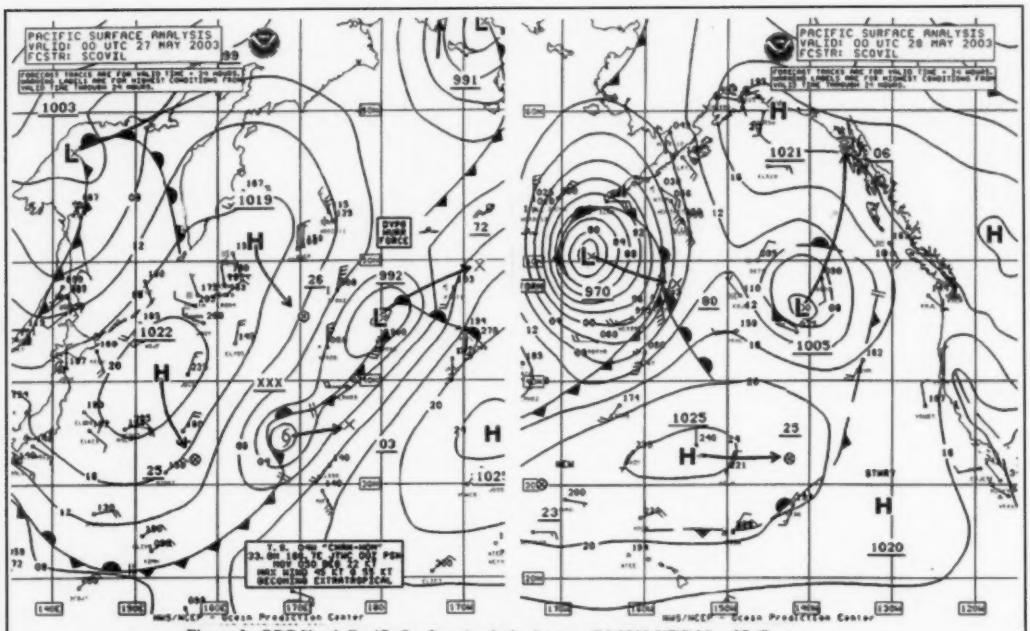


Figure 2. OPC North Pacific Surface Analysis charts valid 0000 UTC May 27 (Part 2 – west) and 0000 UTC May 28, 2003 (Part 1 – east).

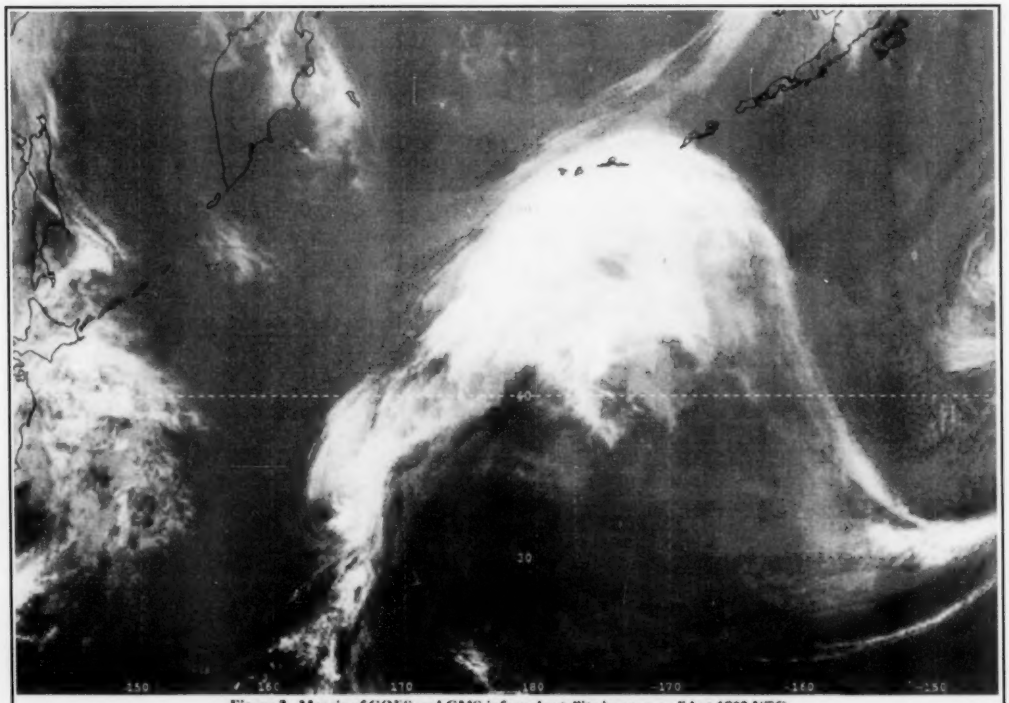


Figure 3. Mosaic of GOES and GMS infrared satellite imagery valid at 1802 UTC May 26, 2003. Satellite senses temperature, which is displayed on a scale from warm (black) to cold (white) in this type of imagery.

continued from page 43

The second part of Figure 6 shows the situation 48 hours later. While the 953-hPa low drifted north and weakened near the coast, the new developing storm near 37N 163W in the first part of Figure 6 moved east-northeast and deepened rapidly before turning north about 300 nm off the coast. The central pressure dropped 32-hPa to 961-hPa near 42N 137W in the twenty-four hour period ending at 1800 UTC March 14. At 1800 UTC March 14 the ship **ELVL9** near 39N 139W reported west winds of 50KT, while Buoy 46006 (40.9N 137.5W) reported west winds at 50KT with gusts to 59KT. Seas were as high as 9.0 meters (29 feet) at this buoy six hours later.At 0000 UTC March 15 the **APL Japan** (43N 128W) reported south winds of 50KT. By 0400 UTC March 15 Buoy 46002 (42.5N 130.3W) developed southwest winds 39KT with gusts to 56KT with maximum seas of 11.0 meters (36 feet) coming two hours later. A QuikScat pass valid near this time (Figure 7) reveals winds of 50 to 60 kt south of the storm center and 50-kt south winds near the coast ahead of the front, shown inland in Figure 6. Near the coast, Buoy 46207 (50.9N 129.9W) reported southeast winds of 41KT with gusts to 60KT at 1400 UTC March 15 and maximum seas of 8.0 meters (26 feet). The central pressure of the storm bottomed out at 957hPa near 46N 132W six hours prior to passing west of Vancouver Island (second part of Figure 6) and turning more northwest. The center then merged with the gale to the west near 52N 151W on the 16th before lifting north and slowly weakening on the 17th.

North Pacific Storm, March 17-20: Low pressure developed east of Japan near 150E at 0600 UTC March 17 and rapidly intensified to 966hPa near 40N 169E at 0600 UTC March 18, a drop of 32hPa in a 24-hour period. The ship **4XFN** (34N 173E) encountered southwest winds of 45KT and 9-meter seas (30 feet) at this time. OPC analyzed this system as a hurricane-force storm from 1200 to 1800 UTC on the 18th while the center was near 42N 177E. The **Marit Maersk** (OZFC2) reported west winds of 45KT near 38N 179E, about 250-hPa south of the center, at 0000 UTC March 19. The system then tracked northeast into southeast Alaska by late on the 21st and weakened.

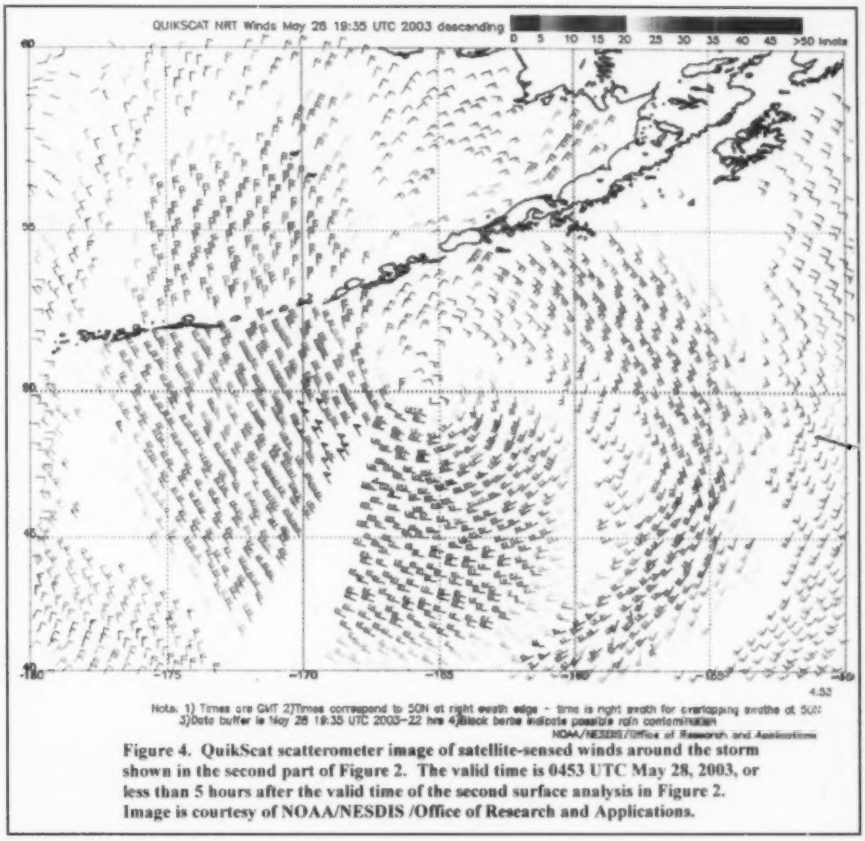

QUIKSCAT NRT Winds May 28 19:35 UTC 2003 descending
0 5 10 15 20 25 30 35 40 45 >50 knots
60
55
50
45
40
-180
-175
-170
-165
-160
-155
-150
4:53
Note: 1) Times are GMT 2)Times correspond to SGN at right swath edge - time is right swath for overlapping swathe at SGN
3)Data buffer is May 28 19:35 UTC 2003-22 hrs 4)Black barbs indicate possible rain contamination
NOAA/NESDIS/Office of Research and Applications

Figure 4. QuikScat scatterometer image of satellite-sensed winds around the storm shown in the second part of Figure 2. The valid time is 0453 UTC May 28, 2003, or less than 5 hours after the valid time of the second surface analysis in Figure 2. Image is courtesy of NOAA/NESDIS /Office of Research and Applications.

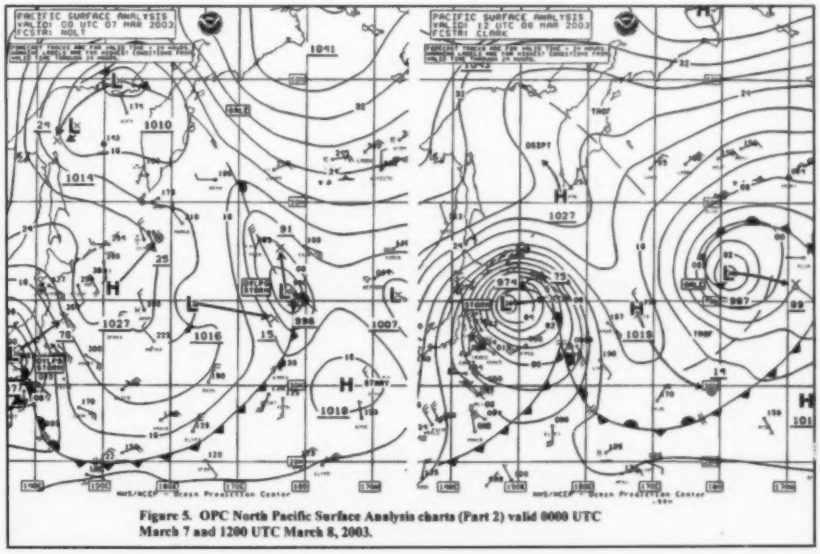


Figure 5. OPC North Pacific Surface Analysis charts (Part 2) valid 0000 UTC March 7 and 1200 UTC March 8, 2003.

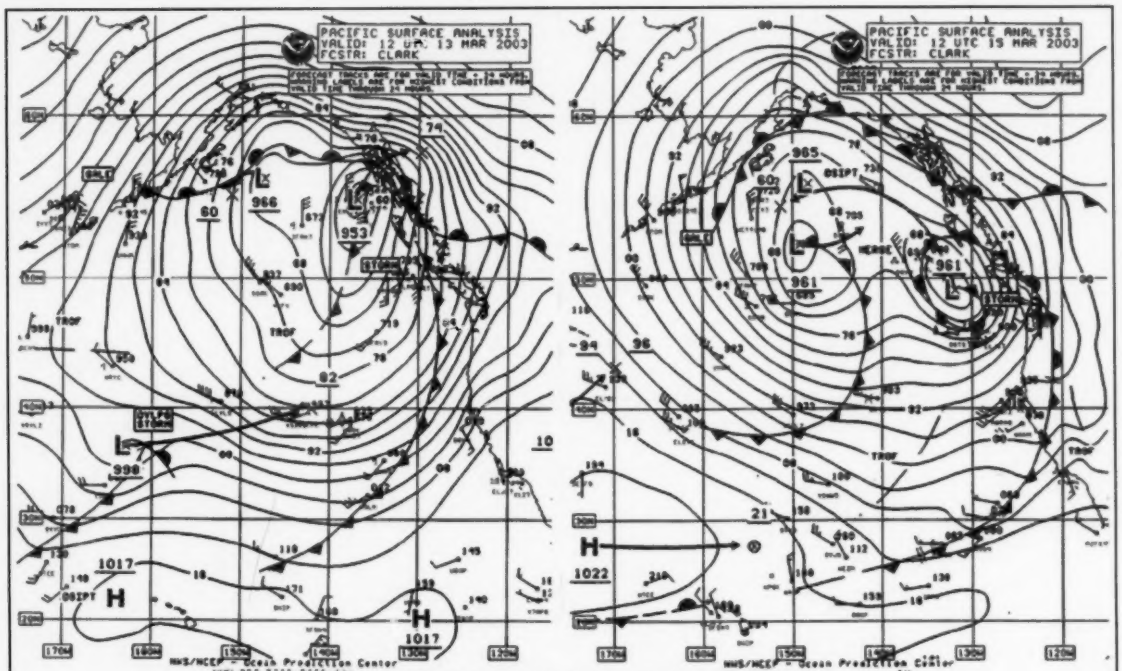


Figure 6. OPC North Pacific Surface Analysis charts (Part 1) valid 1200 UTC March 13 and 15, 2003.

Cutoff Southern Storm, March 26-28: Low pressure passing south of Japan late on the 21st tracked east until reaching 35N 163W on the 26th, where it stalled and intensified to 986 mb. Limited ship data showed winds of 40 to 45 kt, but seas were quite impressive. The **Mahimahi** (WHRN, near 31N 163W) reported west winds of 45KT and 13-meter seas (42 feet) at 0000 UTC March 27. At 1800 UTC March 27 the same ship near 31N 156W encountered west winds of 40KT and 12-meter seas (39 feet). The storm subsequently drifted northeast, then weakened and elongated into Gulf of Alaska on the 28th, before moving into Alaska on the 30th.

North Pacific/ Bering Sea Storm, April 21-24: This system was the strongest of a series of lows to affect the North Pacific and Bering Sea after developing east or northeast of Japan. Figure 8 shows the development of this storm over a 48-hour period. The center developed a central pressure as low as 967-hPa in the central Bering Sea at 0000 UTC April 24, before starting a weakening trend and moving inland over Russia by the 25th.

At 1800 UTC April 22, the ship **C6SI4** (48N 166E) reported north winds of 45 KT and 10.5-meter seas (34 feet). Twelve hours later the same vessel near 48N 171E (plotted in Figure 8) reported west winds of 60KT and seas of 16 meters (53 feet). The author cannot confirm the accuracy of the reported sea height, which was much higher than other reports. The ship **ZNZH6** reported a southwest wind of 65KT and 7.5-meter seas (24 feet) near 52N 178W at 1800 UTC April 23. The same ship encountered southwest winds of 50KT and 10-meter seas (33 feet) near 52N 179W six hours later.

North Pacific Storm of May 17-18: The development of this storm is depicted in Figure 9 with the center tracking northeast off Japan before turning more east, just south of the central Aleutians. Limited ship data showed winds of no more than 35KT, but QuikScat data (Figure 10) valid about six hours prior to the valid time of the second part of Figure 9 reveals 50KT winds south of the center.

The ship **ELXZ9** (45N 175W) reported 8-meter seas (26 feet) along with 30-kt west winds at 1800 UTC May 18. The system later weakened in the southern Gulf of Alaska late on the 21st.

References

1. Rippey, Brad, Weatherwatch (Weatherwise, July/August 2003)

2. Luke, Robert (NDBC), E-mail communication ("Deep Low Pressure Systems from MWL, September 13, 2002)

3. Sienkiewicz, J. and Chesneau, L., Mariner's Guide to the 500-Mb Chart (Mariners Weather Log, Winter 1995)

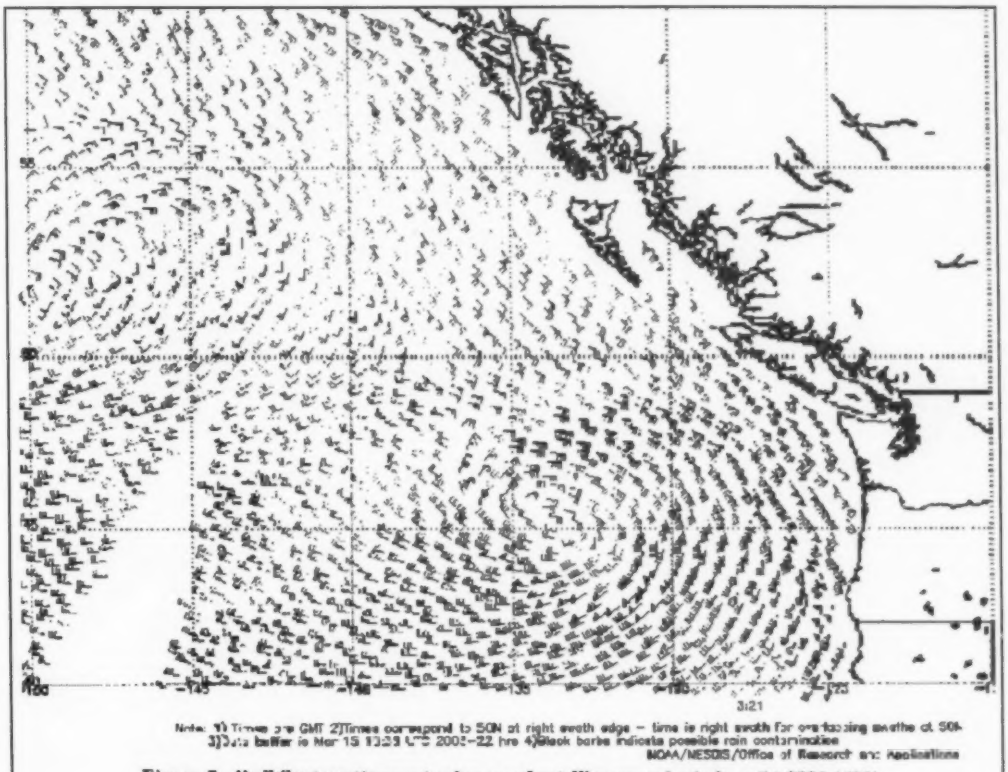


Figure 7. QuikScat scatterometer image of satellite-sensed winds valid 0321 UTC March 15, 2003. The valid time of the pass is less than nine hours prior to the valid time of the second surface analysis in Figure 6. Image is courtesy of NOAA/NESDIS /Office of Research and Applications.

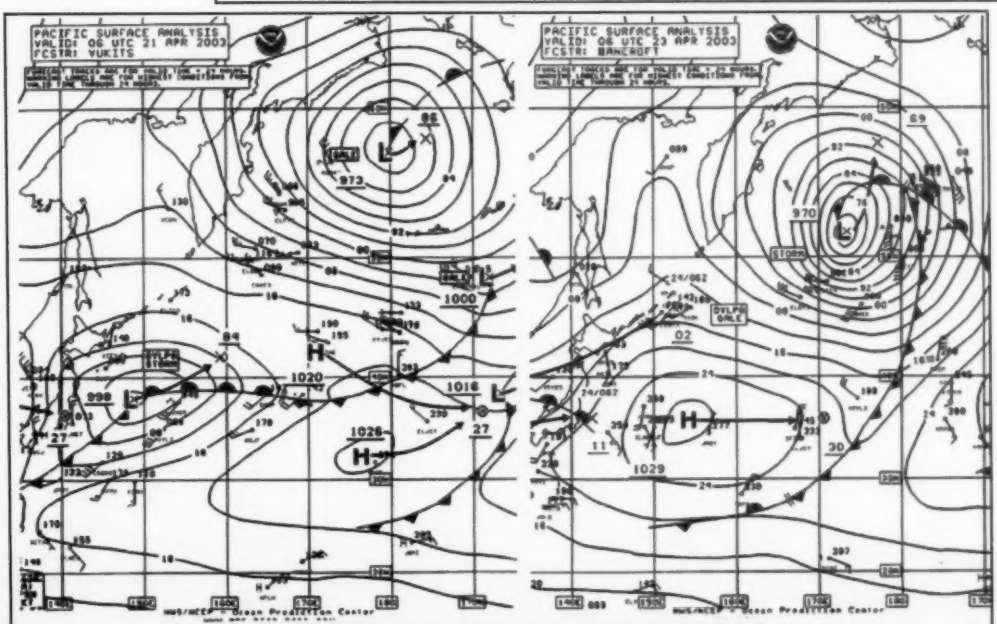


Figure 8. OPC North Pacific Surface Analysis charts (Part 2) valid 0600 UTC April 21 and 23, 2003.

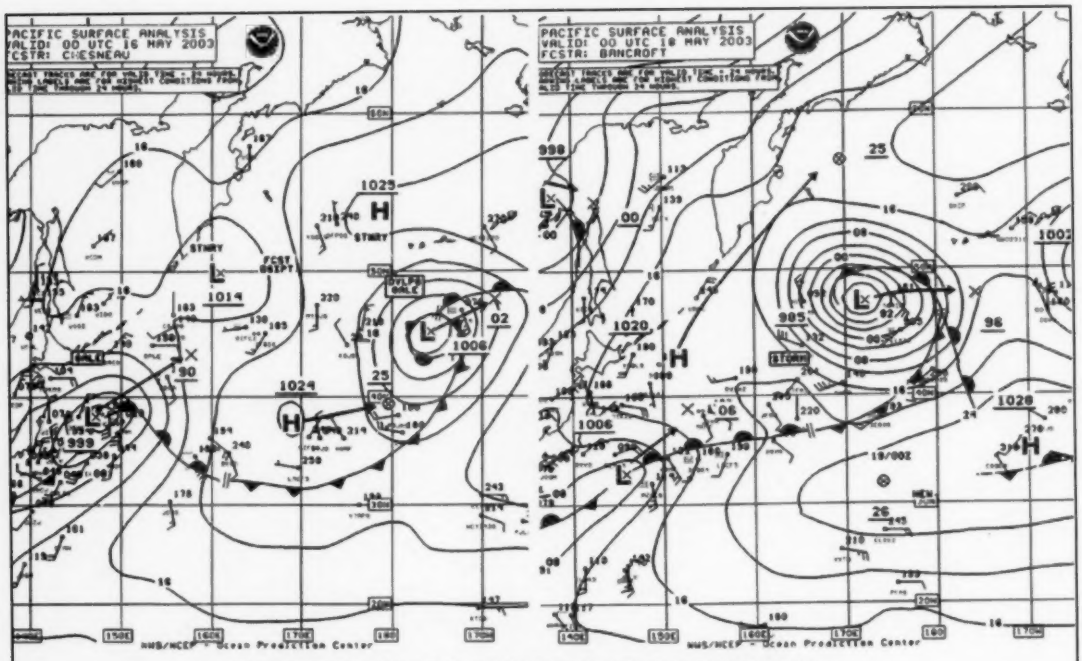


Figure 9. OPC North Pacific Surface Analysis charts (Part 2) valid 0000 UTC May 16 and 18, 2003.

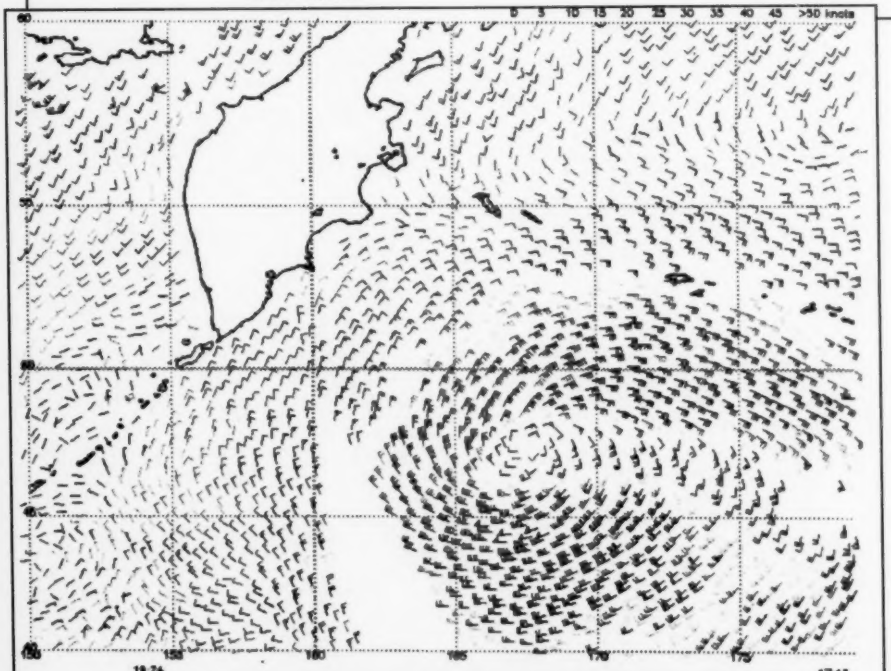


Figure 10. QuikScat scatterometer image of satellite-sensed winds around the storm shown in the second part of Figure 9. The valid time of the pass is approximately 1800 UTC May 17, 2003, or six hours prior to the valid time of the second surface analysis in Figure 9 (from NOAA/NESDIS /Office of Research and Applications).

Tropical Atlantic and Tropical East Pacific Areas
January - June 2003

Daniel P. Brown and
Hugh D. Cobb III
Tropical Analysis and Forecast Branch,
Tropical Prediction Center
Miami, Florida

Atlantic, Caribbean and Gulf of Mexico:

In January, a large long-wave trough became established over the eastern United States. This trough allowed several strong cold fronts to move through the southeast United States and the Gulf of Mexico. Several of these fronts produced gale force winds over the Gulf of Mexico and western Atlantic. These cold fronts also brought unusually cold weather to the southeast United States and Florida. In February and early March, a more tranquil weather pattern occurred over the subtropical Atlantic and Gulf of Mexico, as there were no gale events south of 31 N. However, in late March, a strong cold front again produced gales over the Gulf of Mexico and northwest Caribbean Sea.

In April, a very unusual event occurred when the first Atlantic tropical storm of 2003 formed. Ana initially formed as an extra-tropical low between Bermuda and the eastern United States on 18 April. The extra-tropical low produced an area of gales mainly north of 31 N. The low remained nearly stationary on the 19th and became detached from any frontal systems on the 20th. Thunderstorm activity began forming near the center and the system was first classified as a subtropical storm early on the 21st. Ana eventually became a tropical storm on the 22th. Ana is the first April Atlantic tropical storm in history. A more detailed summary of Ana will be included in the yearly Atlantic Tropical Cyclone Review in the next edition of Mariner's Weather Log.

Western Atlantic Cold Fronts 1-2 January and 7-8 January: On the 1st of January, a strong low pressure center moved across the southeast United States and into the mid-Atlantic region. The trailing cold front moved rapidly across the eastern Gulf of Mexico, Florida and into the western Atlantic early on the 1st. Ahead of this front, the winds increased to gale force over portions of the western Atlantic shortly after 0600 UTC on the 1st. A QuikSCAT pass at 1059 UTC confirmed the presence of gale force winds as it detected south to southwest winds of 30 to 40KT north of 29 N west of 75 W. Sea heights of 5-meters (16 ft) were observed at buoy 41010 (near 29 N 78.5 W) at 1400 UTC. By 1800 UTC 1 January, the low was centered over Virginia, with the trailing front extending across eastern North Carolina. The front continued south across the western Atlantic through 31 N 77 W to south Florida. Another QuikSCAT pass at 2319 UTC indicated that the area of gale force winds extended eastward to 68 W. By 1200 UTC 2 January, the low pressure center had moved off the coast of New England. The trailing front extend through 31 N 70 W to the northern Bahamas. By this time winds decreased below gale force south of 31 N. Further north, the low produced heavy snowfall across Pennsylvania, New York, and portions of New England.

Another strong cold front moved off the southeast United States coast around 1200 UTC 6 January. Early on the 7th the front extended from 31 N 76 W across south central Florida. Strong high pressure began building southward behind the front. At 0600 UTC, winds increased to gale force north of 29 N west of the front. A 1004 UTC QuikSCAT pass detected gale force winds.

At 1800 UTC the front extended from near Bermuda across the central Bahamas to western Cuba. At the same time, the ship **Liberty Star** (call sign WCBP) encountered 35KT winds northwest of the front. By 0000 UTC 8 January, the front reached from 31 N 62 W across the central Bahamas to central Cuba. At this time, winds decreased below gale force south of 31 N.

Gulf of Mexico and Western Atlantic Cold Fronts 16-17 January and 23-25 January: In mid to late January, two very strong cold fronts moved across the southeast United States and the Gulf of Mexico. The first cold front moved off the Texas coast shortly after 1200 UTC 16 January. Behind the front strong high pressure built southward, producing northerly gale force winds. At 0000 UTC 17 January, the front extended from extreme southeast Louisiana to near Tampico, Mexico. The ship **Lykes Discoverer** (call sign WGXO) observed northerly winds of 35KT off the coast of southeast Louisiana at 0600 UTC. Nearby, the C-man station at Southwest Pass, Louisiana (BURL1) reported 36 KT sustained winds. At 1200 UTC, the front extended from just north of Fort Myers, Florida to the Bay of Campeche. The ship **Celebration** (call sign H3GQ) encountered northerly winds of 35KT near 24 N 89 W. By 1800 UTC, the front extended from near 31 N 73 W in the western Atlantic, across the Straits of Florida to the Yucatan Peninsula. Shortly after this time, winds decreased below gale force over the Gulf of Mexico. However, a brief period of gales occurred over the western Atlantic north of 29 N northwest of the front until 0600 UTC 17 January. This front brought record cold weather to portions of the southeast United States and Florida.

The next strong cold front moved off the coast of Texas coast just before 1200 UTC 22 January. At 0000 UTC 23 January, the front extend from north Florida to the Texas-Mexico Border. As the front moved off the southeast U.S. coast a low pressure center developed rapidly along the front off the Georgia coastline. At 1200 UTC, the low deepened into a 1002 mb gale center near 32 N 75 W. The strong cold front extended southwest from the gale center across central Florida to near Veracruz, Mexico. At this time, strong high pressure began building southward, behind the front and gale center. The tight pressure gradient began producing gale force winds over the eastern Gulf of Mexico and western Atlantic northwest of the front. At 1800 UTC 23 January, the ship **Tucano** (call sign VRVP2) observed 40 kt westerly winds over the western Atlantic near 27 N 75 W. At 2000 UTC, buoy 41010 reported 34 kt winds with gusts to 42KT. Sea heights at the buoy built to 5.4-meters (18 ft) on 24 January. The **Tucano** and the **Edyth L** (call sign C6YC) both encountered 40KT winds at 0000 UTC 24 January. QuikSCAT data confirmed the ship observations when it detected a large area of 30 to 40KT winds north of 27 N between 68 W and 78 W.

At 0600 UTC 24 January, the gale center strengthened into a storm with hurricane force winds well north of 31 N. The trailing cold front extend through 31 N 62 W across central Cuba and the northwest Caribbean Sea. Two QuikSCAT passes between 0900 and 1200 UTC continued to detect 30 to 40KT winds over the western Atlantic north of 27 N. A visible satellite image from 1815 UTC 24 January (Figure 1) depicts the classic cold front draped across the Atlantic. Behind the front, cold air stratocumulus clouds covered the entire western Atlantic, northwest Caribbean, and much of the Gulf of Mexico. A 2145 UTC QuikSCAT pass continued to detect gale force winds north of 28 N west of the front to about 70 W.

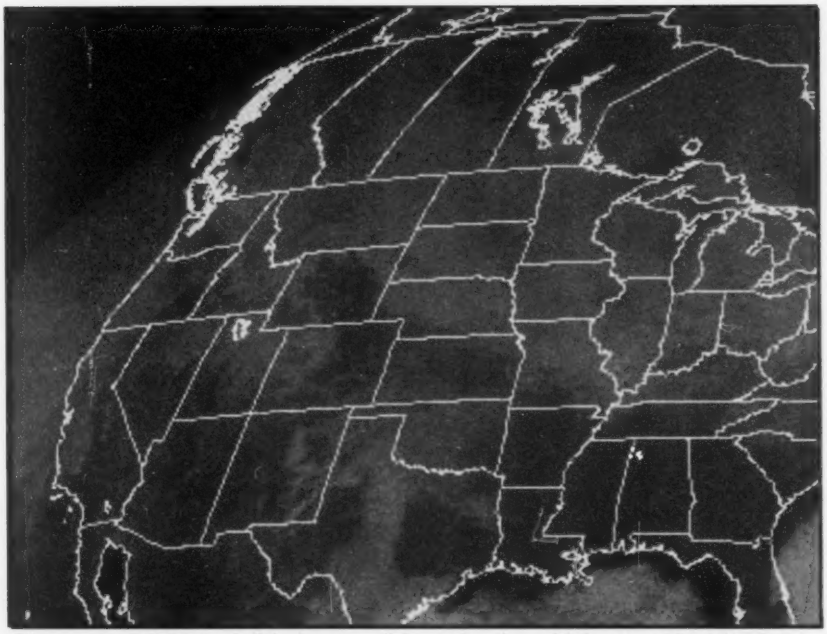
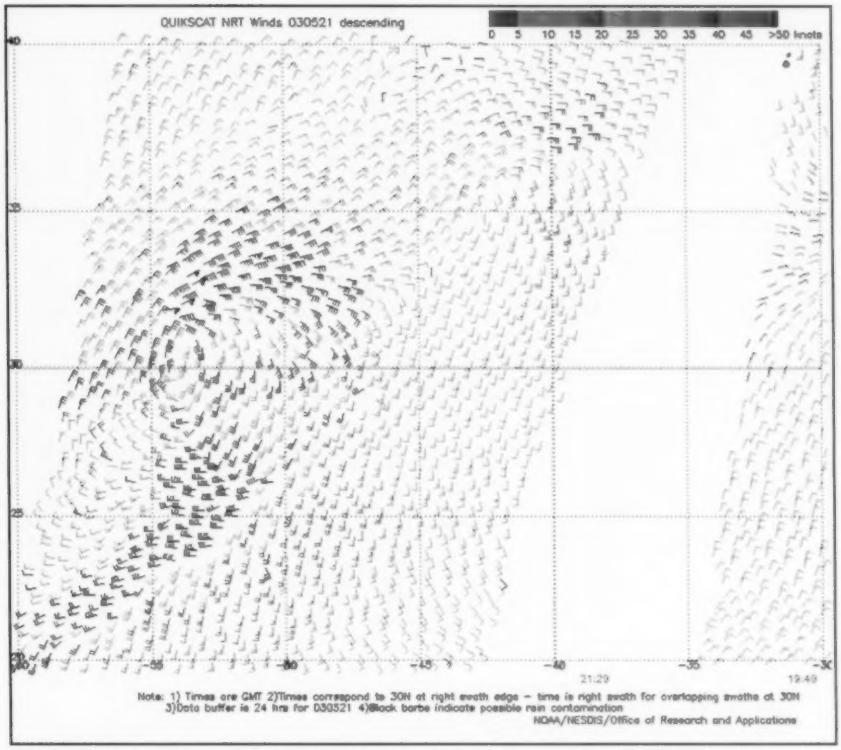


Figure 1. GOES 8 visible image of the Atlantic cold front at 1815 UTC 24 January 2003. Note, the large area of stratocumulus colds that cover the Atlantic and Gulf of Mexico northwest of the front.

At 0000 UTC 25 January, the front extend from 31 N 56 W across Hispaniola to the southwest Caribbean Sea. By 1800 UTC 25 January, winds finally decreased below gale force over the Atlantic south of 31 N. Not only did this system produce a large area of gales in the Atlantic, it also brought significant snowfall to much of the Carolinas, including the Outer Banks of North Carolina. The cold front brought some of the coldest temperatures to Florida since the Christmas freeze of 1989. Freezing temperatures were observed over most of the state including the interior sections of south Florida on the morning of the 24th.

Gulf of Mexico and NW Caribbean Strong Cold Front 29-31 March: A slow moving cold front moved off the Texas coast shortly before 1800 UTC 28 March. At 0000 UTC 29 March, the front extended from the Louisiana coast southwest to near Tampico, Mexico. Strong high pressure began building southward across Texas and the western Gulf behind the front.

Northerly gale force winds began blowing along the coast of Mexico shortly after 0600 UTC 29 March. An 1152 UTC QuikSCAT pass detected 30 to 35 KT winds south of 26 N west of 95 W. At 0000 UTC 30 March, the front extended from the Florida panhandle across the central Gulf of Mexico to the eastern Bay of Campeche. At 1200 UTC 30 March, the front reached from just north of Tampa to the northeast Yucatan Peninsula. A strong 1035-hPa high pressure center moved south into northeastern Mexico. The tight pressure gradient continued to produce gale force winds over most of the southern Gulf. Over the south-central gulf, two ships, the **Nedlloyd Holland** (call sign KRHX) and **C6FM7** (name unknown), encountered 35KT winds at 1200 UTC 30 March. By 0000 UTC 31 March, the front extended across the extreme western Atlantic and western Cuba to near the Gulf of Honduras. Winds decreased below gale force over the Gulf of Mexico waters as northwesterly winds over the Yucatan Channel and the northwestern Caribbean Sea increased to 30 to 40KT.


QUIKSCAT NRT Winds 030521 descending
0 5 10 15 20 25 30 35 40 45 >50 knots
40
35
30
25
-55
-50
-45
-40
-35
21:29
19:49
Note: 1) Times are GMT 2)Times correspond to 30N at right swath edge – time is right swath for overlapping swaths at 30N
3)Data buffer is 24 hrs for 030521 4)Black barbs indicate possible rain contamination
NOAA/NESDIS/Office of Research and Applications

A timely QuikSCAT pass from near 0000 UTC 31 March (Figure 2) detected the presence of gale force winds. It is unusual for gales to occur in the northwestern Caribbean. However, during this event the strong high moved very far south into northern Mexico. At 0600 UTC and 1200 UTC, the ship **Edyth L** observed 40 kt winds off the coast of Belize. By 1800 UTC 31 March, the front extended across the Caribbean from eastern Cuba across Jamaica to Costa Rica. By this time, winds decreased below gale force over the Caribbean. However, strong north to northeast winds continued to blow across much of the western Caribbean through 2 April.

Southwest Gulf of Mexico Cold Front 8-9 April: Another strong cold front moved off the Texas coast just before 1200 UTC 8 April. High pressure began building southward behind the front and winds increased to gale force along the coast of Mexico late on the 8th. During this event, the high pressure center was much weaker than during the event in late March. Therefore, gale force winds were confined to the extreme southwestern Gulf of Mexico. By 0000 UTC 9 April, the front reached from the Florida panhandle to just southeast of Veracruz. A 0106 UTC QuikSCAT pass detected 30 to 35 kt northerly winds south of 25 N west of 95 W. At 1200 UTC, the ship **Pacific Explorer** (call sign V7DN3) encountered 40KT winds just off the coast of Veracruz. By 0000 UTC 10 April, high pressure settled over the western Gulf and winds decreased below gale force.

Central Atlantic Gale 21-23 May: Late on 20 May, a cold front became stationary across the central and western Atlantic along 31 N 48 W - 25 N 63 W to the northern Bahamas. Early on the 21st, low pressure began forming on the front near 28 N 56 W. The low quickly strengthened and became a 1004 mb gale center near 30 N 54 W at 1800 UTC. A 2129 UTC QuikSCAT pass (Figure 3) detected gale force winds, mainly over the northeast semicircle. At 0000 UTC 22 May, the gale became a storm near 31 N 53 W. However, the storm force winds remained north of 31 N. A cold front was analyzed from the storm center, south-southwest to near Puerto Rico. At this time, southwesterly gales developed east of the front and north of 28 N. These gales were confirmed by a 0843 UTC QuikSCAT pass. Gales also continued along 31 N within 240 NM west of the center. At 1200 UTC 22 May, the storm center was located well north of 31 N with the front trailing through 31 N49 W to northeast of the Leeward Islands. Gale force winds continued east of the front north of 29 N until 1800 UTC. Throughout the duration of this event there were very few ship observations near the storm center. The lack of ship data at the time suggested that most ships avoided the area due to the forecast of gale and storm winds.

Eastern North Pacific

The eastern North Pacific was affected by nine Gulf of Tehuantepec gale and storm events in the January through June 2003 (Table 1) period. Four were storm events. In addition, a gale center moving across the Pacific along 30N toward California spread gale force winds across the northern sections of the forecast area from 9-11 February. The storm of 30 March - 2 April was the strongest wind event ever observed in the Gulf of Tehuantepec since the advent of QuikSCAT data with hurricane force winds noted on the 2358 UTC 30 March QuikSCAT pass. See the significant storm event section below for additional details on this event. This event eclipsed the 17-19 November 2002 event discussed in the previous issue of Mariner's Weather Log. Overall, during the fall and winter Tehuantepec season of 2002-2003 (November-April) there were 20 gale and storm events. This is significantly higher than the average (15) over the past four years (Cobb et al, 2003).

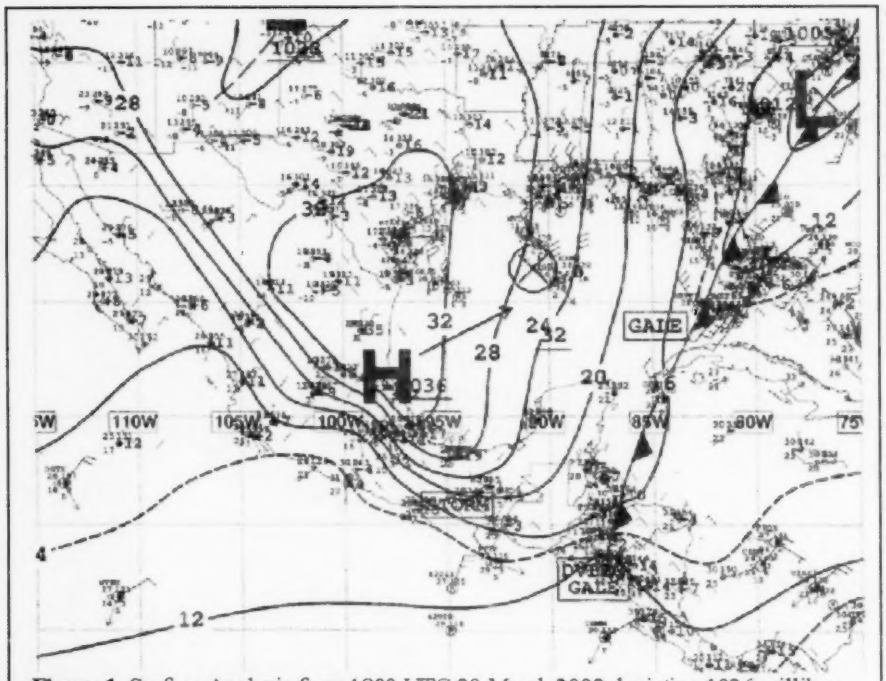
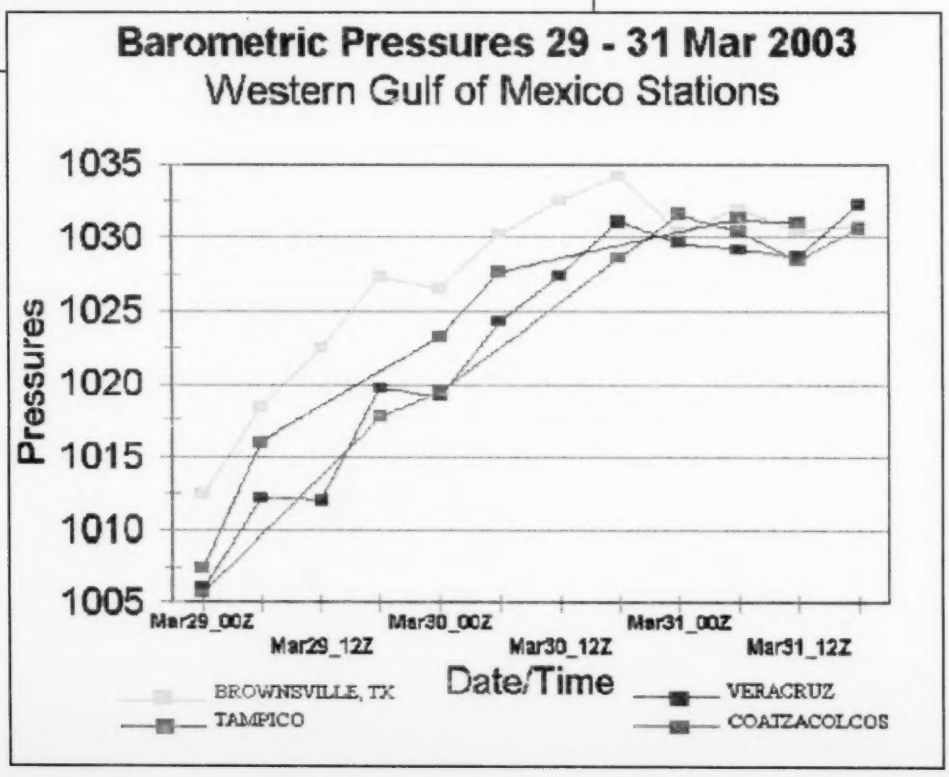


Figure 1 Surface Analysis from 1800 UTC 30 March 2003 depicting 1036 millibar surface High over Tampico, Mexico with very tight pressure gradient across the Isthmus of Tehuantepec 6 hours before the onset of hurricane force winds in the Gulf of Tehuantepec.

The overall synoptic pattern featured a broad trough across the eastern half of the United States with frequent surges of polar and arctic air into the Gulf of Mexico and Bay of Campeche in January and early February. The pattern relaxed in late February and most of March. In late March a very deep trough for early spring moved across the southern United States bringing near record high pressures across northern Mexico.

Despite the number of cold air outbreaks, there were only a few instances where highs with pressures of 1035-hPa or greater moving out of the plains into the southern United States. A notable exception was during the severe storm event on 30 March where unusually strong high pressure extended well south into Mexico (Figure 4).



Gulf of Tehuantepec Gale and Storm Events
January - June, 2003

Event	Beginning	Ending
1	0000 UTC 03 January	1200 UTC 05 January
2*	0600 UTC 07 January	1200 UTC 09 January
3*	1800 UTC 13 January	1500 UTC 20 January
4	0000 UTC 24 January	1200 UTC 25 January
5	1200 UTC 27 January	0000 UTC 29 January
6	0000 UTC 08 February	0000 UTC 09 February
7	0000 UTC 17 February	1200 UTC 18 February
8*	0000 UTC 30 March	0600 UTC 02 April
9	1200 UTC 09 April	0000 UTC 11 April

Table 1. Estimated beginning and ending times for Gulf of Tehuantepec gale and storm events from January through June, 2003. Storm events are denoted with an asterisk (*).

Gulf of Tehuantepec Storm Event 31 March - 2 April 2003: The hurricane force storm event of 30 March-1 April 2003 stands as the strongest Tehuantepec event observed since the advent of QuikSCAT data. The storm event began at 0000 UTC 30 March and lasted until 1200 UTC 1 April. A very sharp mid-to upper-level trough moved across the Central United States around 0000 UTC 30 March and was amplifying as it moved eastward, digging well into the Gulf of Mexico between 1200 UTC 30 March and 0000 UTC 31 March. The associated strong surface anticyclone moved from the central plains southward into northern Mexico by 1200 UTC 30 March with a central pressure of 1035 mb. This was one of the strongest anticyclones to move into Mexico. At 1800 UTC 30 March the anticyclone strengthened slightly to 1036 mb while located near Tampico, Mexico. Surface pressure rises of 25-hPa were common across the western Gulf of Mexico (Figure 5). At 0000 UTC a pressure gradient of 17-hPa across the Isthmus of Tehuantepec and Chevalis Pass resulted in hurricane force gap winds in the Gulf of Tehuantepec as indicated by a 2358 UTC 30 March QuikSCAT pass (Figure 6). QuikSCAT indicated a large area of 50 to 60-kt winds with a 65KT wind at the entrance of the Gulf of Tehuantepec. 18 hours later, the ship **Stuttgart Express** (call sign DGBE) reported NE winds of 60 kt and seas of 7-meters (23 ft) while located near 14.7 N 96.2 W.

Additional Gulf of Tehuantepec Events: The first three Gulf of Tehuantepec events occurred within the first two weeks of January and all attained storm intensity. The first event began at 0000 UTC 3 January and lasted until 1200 UTC 5 January. A QuikSCAT pass at 1142 UTC 3 January indicated 40 to 45 KT winds in the Gulf of Tehuantepec with a 50KT flag at the entrance of the Gulf. Another pass at 2348 UTC the same day indicated an expansion of the area of 50KT winds to include most of the Gulf of Tehuantepec. The ship **Sea-Land Racer** (call sign V7AP8) located near 13.5 N 94.5 W reported NNE winds of 35 KT and 4-meters (13 ft) seas at 1800 UTC 3 January. Another ship, the **Skauboard** (call sign LACF5) located near 14.5 N 96.2 W, reported northerly winds of 30KT and 5-meters (18 ft) seas at 0600 UTC 4 January.

The second event began at 0600 UTC 7 January and lasted until 0600 UTC 9 January. This event was considered the strongest of the three. A QuikSCAT pass, at 2345 UTC 7 January, once again indicated 45 to 50 kt storm force winds in the Gulf of Tehuantepec. There were several ship reports of storm force winds associated with this event. The ship **Zim-Iberia** (call sign 4XFP) located near 13.8 N 94.0 W reported northerly winds of 30KT and 4- meters (13 ft) seas at 0600 UTC 7 January.At 1200 UTC 7 January the same ship while located near 14.5 N 95.7 W reported northeast winds of 50KT and 6 meter (20 ft) seas.

The ship **Overseas Joyce** (call sign WUQL) reported north-northeast winds of 60KT and seas of 5-meters (18 ft) at 0000 UTC 8 January.

The final event in this series began at 1800 UTC 13 January and lasted nearly a week until 1200 UTC 20 January. This was one of the longest period of gale and storm force winds observed in the Gulf of Tehuantepec and coincided with an extended period of very cold temperatures across the southeastern United States. Gale force winds were observed on a number of QuikSCAT passes in this time period. Storm force winds were observed only on the 1159 UTC 14 January and 0015 UTC 15 January QuikSCAT passes. At 1800 UTC 16 January the ship **Chevron Nagasaki** (call sign C6FD6) located near 15.0 N 95.4 W reported northeast winds of 35KT and seas of 3.5-meters (11 ft). Another ship, the **APL Turquoise** (call sign 9VVY) located near 12.5 N 96.0 W reported northeast winds of 35KT and seas of 4.5-meters (15 ft) at 0000 UTC 18 January. At 1800 UTC 19 January the ship with call sign **3FEK9** (name unknown) located near 12.7 N 97.7 W reported northeast winds of 35KT and seas of 3 meters (10 ft).

The fourth event occurred within four days after the end of the extended third gale. The gale event began at 0000 UTC 24 January and ended at 1800 UTC 25 January. The ship **Neptune Alexandrite** (call sign 9VBA) located near 13.8 N 95.5 W reported near gale force east-northeast winds of 30 to 35KT but no sea heights were indicated.

The fifth event in the month of January began at 1200 UTC 27 January and lasted until 0000 UTC 29 January. A QuikSCAT pass at 2356 UTC 27 January indicated 30 to 35KT winds in the Gulf of Tehuantepec. At 0600 UTC 28 January, the ship **Saga Spray** (call signVRWW5) located near 15 N 100 W reported northeast winds of 30 to 35KT. At 1800 UTC 28 January the ship with call sign **Z6HU6** (name unknown) located near 14.7 N 96.0 W reported east-northeast winds of 30 to 35KT and seas of 3-meters (10 ft).

The first event for the month of February began at 0000 UTC 8 February and lasted until 0000 UTC 9 February. At 1800 UTC 8 February the ship **Super Servant 3** (call sign PJPN) located near 14.5 N 95.8 W reported northeast winds of 30 to 35KT with a 2.5-meters (9 ft) sea.

The second event for the month of February began at 0000 UTC 17 February and lasted until 1200 UTC 18 February. A QuikSCAT pass from 0055 UTC 18 February indicated 30 to 35KT winds in the Gulf of Tehuantepec. There were no ship reports of gale or near gale force winds with this event.

The final event of this period began at 1200 UTC 9 April and lasted until 0000 UTC 11 April. A QuikSCAT pass at 0021 UTC 10 April indicated a large area of 40 to 45KT winds in the Gulf of Tehuantepec. There were no ship reports of winds of gale force or stronger associated with this event.

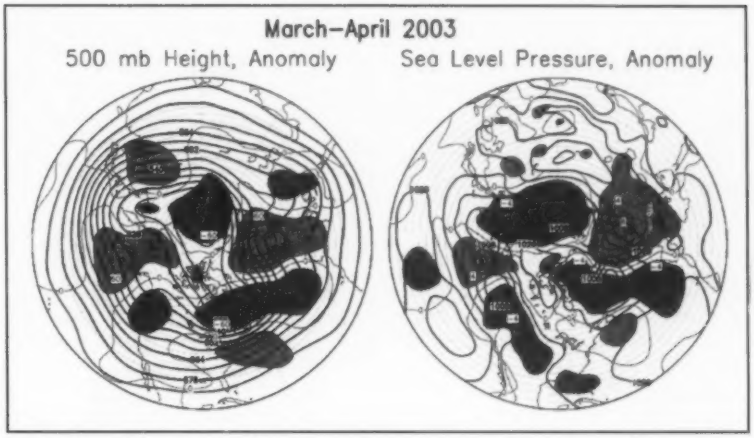
Southern California Gale 9-11 February: A very deep trough and associated low pressure area moved southward into the High Seas forecast area near 30 N135 W around 0000 UTC 9 February and moved east-southeastward to near 26 N130 W by 1200 UTC 11 February. Gale force winds were observed in the area for a period of 66 hours. The low/gale center was accompanied by 30 to 35KT winds and seas of 3 to 4.5-meters (10 to 15 ft) over the entire span of the event.
At 0600 UTC 9 February, the ship **P&O Ned Lloyd Atacama** (call signELZF7) located near 26.2 N 127.5 W or about 450 nm southeast of the Gale center reported SE winds of 30 to 35KT and 3 meters (10 ft) seas. At 0000 UTC 10 February several ships in the vicinity of the gale center reported near gale to gale force winds. The most notable was the ship **OOCL Fedelity** (call signVRWG5) located near 25.0 N 123.7 W or about 400 nm east-southeast of the Gale center at that time. The ship reported ESE winds of 35KT and seas of 4-meters (15 ft). At 0600 UTC 10 February the NOAA ship **Ka' Imimoana** (call signWTEU) located near 22 N121 W reported east-southeast winds of 35KT and seas 3.5 to 4.5-meters (12 to 15 ft). At 1200 UTC 10 February, the ship **Lihue** (call signWTST) located near 26 N138 W reported northerly winds of 35KT and seas of 5-meters (17 ft). At 1800 UTC 10 February, the ship **Sealand Navigator** (call signWPGK) located near 31 N133.7 W reported north-northeast winds of 35KT and seas of 4-meters (13 ft). At the same time there were at least 4 other ships reporting winds of 30 to 35KT or greater in the area from 25 N to 30 N between 135 W and 140 W. At 0000 UTC 11 February ship **Lihue** again reported gale force winds, this time near 35KT while located near 27.5 N134 W. Seas were 3.5-meters (11 ft).

References

Cobb, H.D. III, Brown, Daniel P. and Robert A. Molleda.
The use of QuikSCAT Imagery in the Diagnosis and Detection of Gulf of Tehuantepec Wind Events 1999-2002. Preprints 83rd Annual AMS Meeting - 12th Conference on Satellite Meteorology and Oceanography, p. 410.

Mean Circulation Highlights and Climate Anomalies March through August 2003

A. James Wagner
Senior Forecaster
Forecast Operations Branch
Climate Prediction Center
NCEP/NWS/NOAA.



The chart above shows the seasonal mean sea level pressure at four mb (hPa) intervals in heavy solid lines, labeled in mb(hPa). Anomalies of Sea Level Pressure (SLP) are contoured in dashed lines and labeled at two mb(hPa) intervals, with heavy shading and light solid lines in areas greater than two mb(hPa) above normal, and light shading and light dashed lines in areas more than two mb(hPa) below normal.

MARCH - APRIL 2003

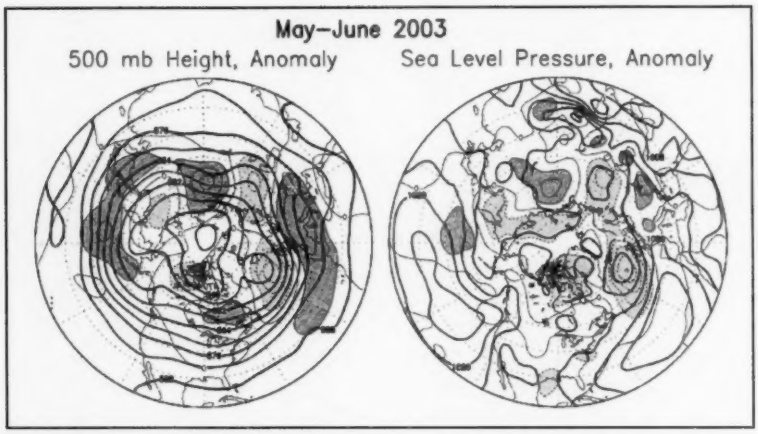
The map of mean 500-mb(hPa) height and height anomalies (left) show a rather complex but generally amplified wave train around the Northern Hemisphere. At high latitudes a wave two pattern prevailed, with troughs over Siberia and northeastern Canada, sandwiched between blocking ridges over the Bering Sea and northern Europe. At middle and lower latitudes, troughs were located near the west coast of North America, across the central Atlantic with a WNW-ESE axis, and over the eastern Mediterranean Sea. A broad flat ridge was located just off the East Coast of the U.S. Storm tracks were about normal over the Pacific, but tended to extend southeastward from British Columbia to the central U.S., where they had a tendency to weaken, except for one system that gave record heavy snows to the Front Range of the Colorado Rockies. Storms over the Atlantic were deflected to the southeast off the coast of Portugal by the strong blocking high pressure over the Baltic and Greenland Seas. This unusually strong area of high pressure also displaced the Icelandic Low, which was stronger than normal, west of its usual position to near southern Greenland. The frequent storms that had affected the Mediterranean area during the winter continued through much of the spring in the eastern part of the area, as some energy in the westerlies made its way across southern Europe to the south of the high.

Unusually cold air remained in place over most of eastern and central Canada, extending as far south as the Great Lakes and New England, while relatively mild temperatures developed over much of the central and southeastern U.S., bringing welcome relief from the long cold winter. Above average precipitation prevailed over the Pacific Northwest in March and extended southward along the entire West Coast during April, when the trough, which had been confined to only the British Columbia coast during March, amplified southward along the entire West Coast of the U.S. The wet spell continued over the Southeast, while dry areas began to appear over the central parts of the country. The strong ridge at the surface and aloft over Europe blocked most Atlantic storms from reaching the area, setting the stage for the severe drought and heat wave that developed during the summer.

Over the Pacific, El Nino conditions, characterized by above normal sea surface temperature (SST) along the equator in the central and eastern parts of the ocean, declined rapidly and were replaced by below normal SSTs off the South American coast, suggesting that a La Nina might be about ready to begin. However, most atmospheric indices, which usually lag the ocean in the lower latitudes, remained in the neutral range.

MAY-JUNE 2003

The circulation during the late spring and early summer months became more zonal over the Western Hemisphere with mostly small departures from normal as shown on the two-month mean maps. However, there was a significant change over the U.S. from a moderately fast westerly pattern in May to a more amplified configuration of a strong ridge just off the West Coast and a trough in the middle Mississippi Valley during June.



The chart above shows the seasonal mean sea level pressure at four mb (hPa) intervals in heavy solid lines, labeled in mb(hPa). Anomalies of Sea Level Pressure (SLP) are contoured in dashed lines and labeled at two mb(hPa) intervals, with heavy shading and light solid lines in areas greater than two mb(hPa) above normal, and light shading and light dashed lines in areas more than two mb(hPa) below normal.

This caused most of the U.S. east of the Rockies to be noticeably cooler than normal, due mainly to extensive periods of cloudy wet weather that cut down on the solar heating. Although the circulation for the whole two-month season or even May by itself does not give an adequate explanatory picture, frequent vigorous short wave troughs in the westerlies coming in from the Pacific, coupled with a strong low-level moisture inflow from the Gulf of Mexico during the first two weeks of May, led to an unprecedented number of tornados over central and eastern parts of the U.S.

The circulation became strongly zonal over the eastern Atlantic, with a southward-displaced stronger than normal Icelandic Low just north of an extensive enhanced ridge extending from the eastern Atlantic across the Mediterranean and all of southern Europe. Abnormally warm weather began to develop over southern and central Europe, while the drought intensified. Farther to the east over Russia, the circulation became more amplified, especially during June, with a strong ridge located between troughs near the Ural mountains and eastern Siberia.

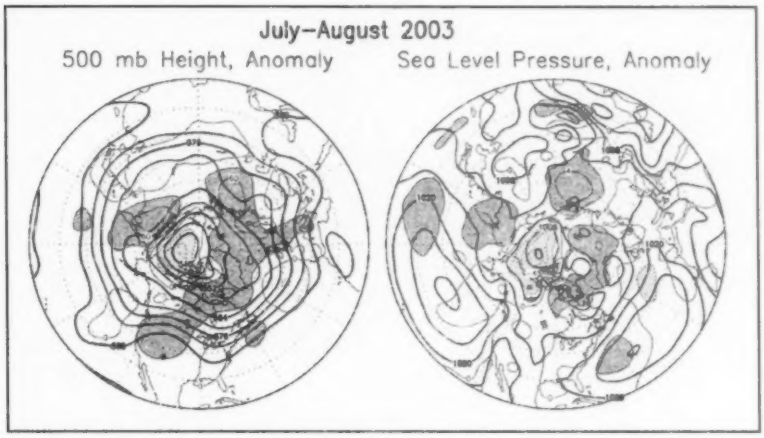
Over the tropical Pacific, the development of La Nina conditions was abruptly halted by an oceanic Kelvin wave initiated by a strong burst of west winds over the western Pacific. Equatorial SSTs were at least 1 C above normal over and just west of the Date Line, while areas of cooler than normal water over the east-central equatorial Pacific decreased. The only decidedly below normal SSTs were located just off the west coast of South America. After moving from a rapidly weakening El Nino pattern towards a weak La Nina configuration during the past three or four months, most atmospheric and oceanic indices paused in their trends, ending up in neutral territory.

A total of three tropical systems, all of tropical storm intensity, formed over the eastern Pacific, and one made landfall in western Mexico. In the Atlantic, after Ana, which developed in April and was the earliest tropical storm on record in the Atlantic sector, there was one other unnamed tropical depression east of the Antilles in early June, and tropical storm Bill contributed to the above average rainfall along the central Gulf coast and parts of the Southeast at the end of the month.

JULY-AUGUST 2003

A moderately amplified version of the normal summertime circulation pattern prevailed in the vicinity of North America, with troughs off the West Coast and extending from Quebec southward through the Appalachians. Between the troughs, a strong ridge over the High Plains extended northeastward across central Canada, and was a part of a large area of higher than normal pressure both at the surface and aloft that extended across the North Atlantic to join with other amplified ridges over western Russia and central Europe. This latter feature became exceptionally strong and shifted over western Europe during the first half of August, leading to an unprecedented heat wave that set all time high temperature records at many locations with records dating back well over a century. The heat was exacerbated by drought and wildfires, especially over more southern locations which had gone longer without significant rainfall.

Record and near-record heat and increasing drought also plagued parts of the United States, especially the Southwest in early July where the summer monsoon was one to two weeks late, and over the central Great Plains and parts of the Rockies throughout July, under the influence of the strong ridge. Numerous wildfires affected the Southwest and the Rocky Mountains during late June and early July. During August the strongest part of the ridge was over the northern Great Plains and upper Mississippi Valley, where many high temperature records were set in areas of expanding drought. Most areas east of the Mississippi River continued to have wetter than normal conditions due to slowly-moving weak frontal systems stalling in the mean trough over the Southeast. Heavy rainfall over southern Texas was due to Hurricane Claudette during July, and a weak tropical depression contributed to the totals over Georgia.



The chart above shows the seasonal mean sea level pressure at four mb (hPa) intervals in heavy solid lines, labeled in mb(hPa). Anomalies of Sea Level Pressure (SLP) are contoured in dashed lines and labeled at two mb(hPa) intervals, with heavy shading and light solid lines in areas greater than two mb(hPa) above normal, and light shading and light dashed lines in areas more than two mb(hPa) below normal.

Over the equatorial Pacific, atmospheric and oceanic indices of the status of the El Nino/Southern Oscillation (ENSO) all remained within a neutral range throughout the two-month period. Warmest SSTs were west of the Date Line, while the only area of substantially below normal SSTs was near the west coast of South America.

A total of seven tropical systems developed over the eastern Pacific during this period, but only two were of hurricane intensity. The Atlantic sector experienced a total of four systems in July, two of which became hurricanes while two remained unnamed tropical depressions. SSTs over almost the entire Atlantic have been significantly above normal throughout the summer, and this, coupled with modulation by Madden-Julian waves moving around the equatorial region, may have contributed to the unusually active early part of the Atlantic tropical storm season. Activity during August was near average, with three tropical cyclones and one hurricane developing. Only one, Tropical Storm Gracie, affected the U.S. mainland, but it did not contribute as much rainfall as tropical systems making landfall in Texas typically do.

About The Author

A. James Wagner is the Senior Forecaster in the Forecast Operations Branch of the Climate Prediction Center NCEP/NWS/NOAA. He participates in the preparation of all the types of forecasts done in the Branch : the 6-10 Day Extended Outlooks, Week Two Outlooks, weekly Hazards Assessment, Monthly Outlooks, and the series of long-lead Seasonal Outlooks going out to a year ahead. Other duties of Mr. Wagner include applied research in developing tools for the various types of forecasts and giving special briefings on the forecasts and their methodology to the media and visiting scientists.

National Weather Service VOS Program New Recruits From May 1, 2003 to October 31, 2003

Name of Ship	Call	Agent Name	Recruiting PMO
ALDEBARAN	WQB6160	ALDEBARAN C/O NWS	KODIAK, AK
AMERICAN NO. 1	WTY8664	F/V AMERICAN NO. 1	KODIAK, AK
AXEL MAERSK	OUUY2	MAERSK PACIFIC, LTD	SEATTLE, WA
CAP SAN ANTONIO	ELZU6	T. PARKER HOST, INC.	NORFOLK, VA
CARNIVAL GLORY BRIDGE	3FFS9	CARNIVAL CRUISE LINES	JACKSONVILLE, FL
COASTAL RELIANCE	WADZ	COASTAL RELIANCE C/O MARINE TRANSPORT CORP.	KODIAK, AK
COASTAL VENTURE	WCY8505	COASTAL TRANSPORTATION	SEATTLE, WA
CORBIN FOSS	WBD5265	CORBIN FOSS C/O FOSS MARITIME	KODIAK, AK
DAVIDSON	WCY3880	DAVIDSON	KODIAK, AK
DEEPWATER HORIZON	H3SM	TRANSOCEAN INC.	HOUSTON, TX
DELAWARE TRADER	WDB3258	MORAN-GULF SHIPPING	HOUSTON, TX
EDITH OLSON	WY8838	TUG EDITH OLSON C/O NORTHLAND SERVICES	KODIAK, AK
FRONTIER ACE	H3CM	WILLIAMS DIMOND & CO	JACKSONVILLE, FL
GALAXY	C6FU6	CELEBRITY CRUISES	BALTIMORE, MD
GLADIATOR	WCZ9000	GLADIATOR C/O NWS	KODIAK, AK
GUARDSMAN	WBN5978	GUARDSMAN C/O CROWLEY MARITIME CO.	ANCHORAGE, AK
GULF TITAN	WDA5598	GULF TITAN C/O WESTERN TOWBOAT	ANCHORAGE, AK
HATSU ELITE	VSJG7	EVERGREEN AMERICA ,CORP.	SEATTLE, WA
HUAL TRUBADOUR	LAUX2	HOEGH FLEET SERVICES	BALTIMORE, MD
INDAMEX DALIAN	S6HU6	AMERICAN PRESIDENT LINES, LTD	NORFOLK, VA
JAG PRAKASH	AUBK	JAG PRAKASH C/O GREAT EASTERN SHIPPING CO. LTD.	ANCHORAGE, AK
JEFFREY FOSS	WCX4608	JEFFREY FOSS C/O FOSS MARITIME	KODIAK, AK
JEPPESEN MAERSK	OXTX2	STRACHAN AGENCIES	NEW YORK CITY, NY
JOHANNES MAERSK	OWFD2	STRACHAN SHIPPING	NEW YORK CITY, NY
JOSEPH SAUSE	WTW9258	JOSEPH SAUSE C/O SAUSE BROS OCEAN TOWING CO.	KODIAK, AK
KIYI	KAO107	LAKE SUPERIOR BIOLOGICAL STATION	CHICAGO, IL
LAUREN FOSS	WDB3834	LAUREN FOSS C/O FOSS MARITIME CO.	KODIAK, AK
LYKES EAGLE	VSUA7	LYKES EAGLE C/O ALASKA MARITIME AGENCIES	ANCHORAGE, AK
M/V FREEDOM	WDB5483	PACIFIC GULF MARINE	BALTIMORE, MD
M/V NORTHWEST EXPLORER	WCZ9007	NORTHWEST EXPLORER C/O B & N FISHERIES	KODIAK, AK
MANUKAI	WRGD	MATSON NAV. CO	NEW YORK CITY, NY
MING AMERICA	A8AZ2	SOLAR INTERNATIONAL	NEW YORK CITY, NY
MSC REBECCA	HONW	MSC (MEDITERRANEAN SHIPPING CO.)	NORFOLK, VA
NAVIGATOR OF THE SEAS	C6FU4		MIAMI, FL
NORTH STAR	KIYI	TOTEM OCEAN TRAILER EXPRESS	SEATTLE, WA
OCEAN RELIANCE	WADY	OCEAN RELIANCE C/O MARINE TRANSPORT CORP.	KODIAK, AK
OLUF MAERSK	OXFU2	STRACHAN AGENCY	NEWARK, NJ
P&O NEDLLOYD DAMMAM	A8CA3	AWN SHIPPING INC., REEDEREI H. WULFF	NORFOLK, VA
PACIFIC TITAN	WCZ6844	PACIFIC TITAN C/O WESTERN TOWBOAT	ANCHORAGE, AK
POLAR DISCOVERY	WACW	POLAR TANKERS INC	NEW ORLEANS, LA
PREMIUM DO BRASIL	A8BL4	MARITIME SERVICES ALEUROPA GMBH	BALTIMORE, MD
PT BROWER	WDA2796	PT BROWER C/O CROWLEY MARITIME CO.	ANCHORAGE, AK
PT. THOMPSON	WBN5092	PT. THOMPSON C/O CROWLEY MARITIME	ANCHORAGE, AK
RED DOG	KYU625	RED DOG C/O FOSS MARITIME RED DOG PORT SITE	KODIAK, AK
RHEA BOUCHARD	WRQ4509	RHEA BOUCHARD C/O 57 CORP	KODIAK, AK
SALLY MAERSK	OYHS2	MAERSK PACIFIC LTD	SEATTLE, WA
SARGASSO	H9YR	OBC SHIPPING INC	HOUSTON, TX
SEA HORSE	WBN4382	SEA HORSE CROWLEY MARITIME	ANCHORAGE, AK
SEA RELIANCE	WEOB	SEA RELIANCE C/O MARINE TRANSPORT CORP.	KODIAK, AK
SEA STORM	WCV9132	SEA STORM C/O NWS	KODIAK, AK
SOUND RELIANCE	WXAE	SOUND RELIANCE C/O MARINE TRANSPORT CORP.	KODIAK, AK
STAR INDIANA	S6BE	WESTFAL-LARSEN MANAGEMENT A/S	BALTIMORE, MD
TMM TABASCO	VSUA5	TMM TABASCO ALASKA MARITIME AGENCIES	ANCHORAGE, AK
U.S. INTREPID	WCX5858	F/V U.S. INTREPID	KODIAK, AK
USNS BENAVIDEZ	NBHG	MASTER	NEW ORLEANS, LA
WESTWOOD VICTORIA	C6SI6	OCEAN AGENCIES	SEATTLE, WA

-- Welcome Aboard and Thanks! -- Luke

Regional News

2002 Special Alaska Marine Award presented to the LNG Tanker *Polar Eagle* with the second highest total of yearly BBXX in Alaskan history with 1,156.
The *Polar Eagle* makes 18 round trips per year between Alaska and Japan.

***Polar Eagle* Officers: (left to right)**
2nd Officer Lorenzano Ciro
1st Officer Colelli Luigi
Captain Sessa Luigi
2nd Officer Caccaho Francesco
2nd Officer Seichili Antonio

Alaska Region (AR)

The Alaskan region presented a Special Alaska Region Marine Award to the LNG Tanker **Polar Eagle** for the second highest total of yearly BBXX observations in Alaskan history. The Polar Eagle submitted 1156 observations in 2002 during their 18 round trip transits between Alaska and Japan.

Crowley Tug Point Brower has set an all time Alaska monthly record for BBXX observations with 234 in July of 2003 Chief Mate Neil Sandvik and 2nd Mate Jake Rosenberg also set a two month observation record of 404 BBXX observations for July and August. These observations were collected during a two month voyage from Seattle, Washington to the Gulf of Alaska, the Bering Sea, Chukchi Sea, Arctic Ocean, Beaufort Sea, and then back to Seattle. The Point Brower observations from these data sparse locations via e-mail and HF radio were very helpful to ensure accurate Alaska weather forecasting.

Chief Mate Neil Sandvik and 2nd Mate Jake Rosenburg of the Crowley Tug *Point Brower* posted an all-time Alaskan monthly record of 234 BBXX in July of 2003. The total for July and August was also a new two month record.

Regional News

Eastern Region (ER)

NEW PMO in CHARLESTON, SC.
Upon the retirement of the Great Lakes Port Meteorological Officer (PMO) in Cleveland, OH, it was determined that is was possible to satisfy the needs of the Great Lakes maritime community in the area with only one PMO. The Great Lakes fleet is now being outstandingly supported by Ms. Amy Seeley, the PMO in Chicago.

This PMO position would be of more benefit to the NWS, its mission, and the public in the Charleston, SC area. An advantage to having a PMO in this area is the fact that CHS and other ports in the area (Savannah, GA; Georgetown, SC; and Wilmington, NC) are increasing their commercial traffic. A PMO stationed at Charleston could easily accommodate their needs as the travel distances between ports are not great.

Over the years Chasleston was more of a military port area than one dedicated to commercial shipping. Since the mid 1990's things in and around Charleston have changed drastically. After closure of most of the military naval bases in the Charleston area, local commercial enterprises took over most of these facilities and started developing them to enhance commerce and trade.
Today the Charleston area is one of the busiest container and cargo area in the Eastern US, with four facilities operating and two more planned (Union Pier Terminal, Columbus Street Terminal, North Charleston Terminal, and Wando Welch Terminal, with Daniel Island and the Old Navy Yard planned).

The PMO at Charleston will be located at the Coastal Services Center, in the Old Navy Yard. This will place the PMO within 10 minutes of most of the facilities operating at this time.

On September 5th, Mr. Tim Kenefick was selected as the new PMO for the Charleston area. Mr. Kenefick has had much experience in the field as he has served as the Newark/New York PMO for the last eight years.

Mr. Kenefick reported for duty in Charleston on October 22nd. A vacancy announcement has already been announced to bring a new PMO into the Newark/New York area. The candidate list was narrowed down to several high qualified individuals. After several interviews and brutal soul searching by the Eastern Region, Mr. Jim Luciani has been selected as the newest PMO to the VOS program. Mr. Luciani is a retired U.S. Navy Meteorologist and opened the Newark office back up on December 15th, 2003.

Editor's Note: You can read more about Jim Luciani in the upcoming April issue of the MWL. - Luke

United Kingdom:

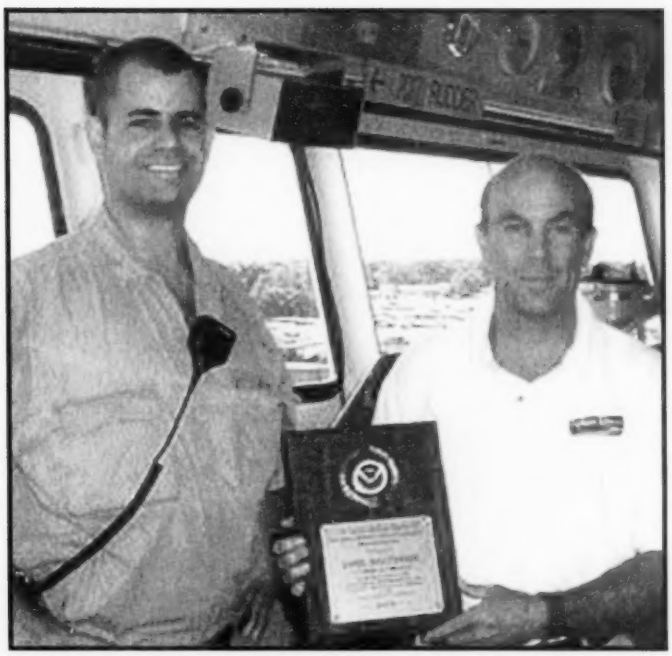
Nautical Officer, Sarah North has advised us that the Headquarters Met Office relocated to Exeter, UK as follows:

Met Office
Fitzroy Road
Exeter
Devon
EX1 3PB
United Kingdom

Tel: +44 (0) 870 900 0100
Fax: +44 (0) 870 900 5050

VOS Program Awards

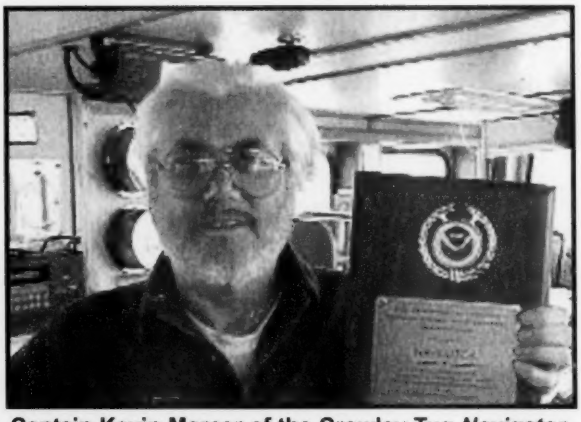
The *Sealand Integrity*, one of 2002's top performers. Her crew took over 2000 Marine Observations last year at three hours intervals. This is her fourth consecutive award. From left to right, NWS PMO Chris Fakes, Captain Wess Winters, Chief Mate Bruce Myrdek, and 3rd Mate Andy Swan. (2nd Mate Ross Schramm not shown)



***Lykes Discoverer* received a 2002 Outstanding Performance Award for the third consecutive year, posting over 900 Marine Observations. (left to right) 2nd Mate Scott McGrough, and Captain William L. Miles. Not pictured but due recognition are Captain Scott Putty and Chief Mate Robert P. Strobel**

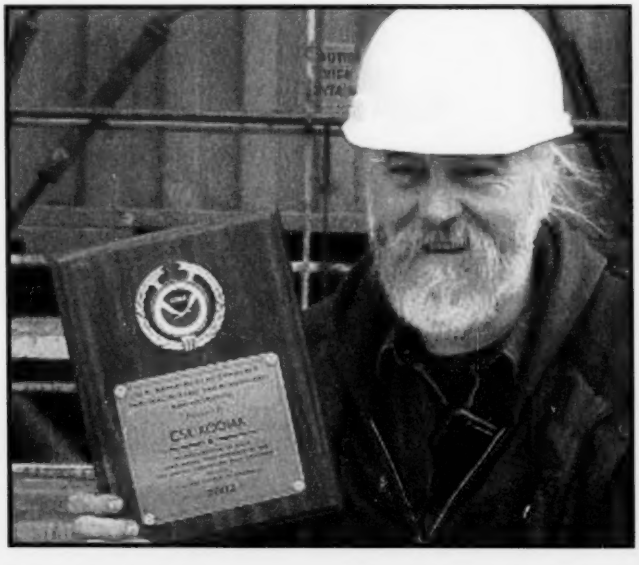
VOS Program Awards

CSX Horizon Anchorage **2nd Mate Bill Fransen and Anchorage PMO Larry Hubble.**
This vessel had the 3rd highest total of BBXX observations, 977, in Alaskan waters for 2002.

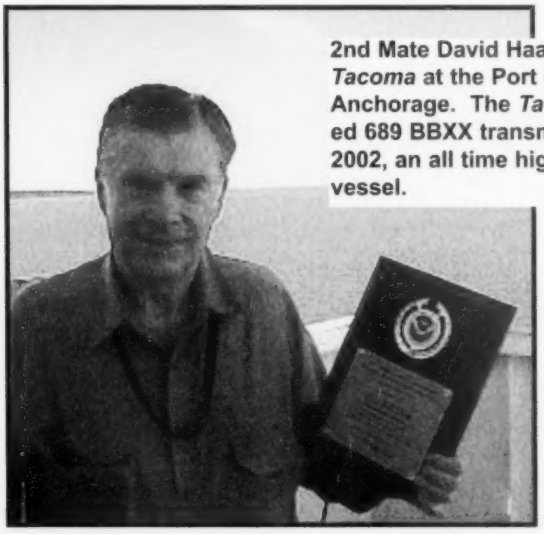


Captain Kevin Mercer of the Crowley Tug *Navigator* at Port of Anchorage. The *Navigator* placed 5th in the Alaska BBXX Ranking, an increase of 510% over their 2001 BMXX count..

CSX Horizon Kodiak **3rd Mate Butch Yarborough. The Kodiak had their best year ever for BBXX with 789 observations.**



Sealand Commitment provided over 800 observations in 2002, helping this vessel become one of the most consistant and accurate over the past five years. From left to right, 2nd Mate Geoff Bird, Captain Frenzen, Carl Frenzen (holding award), Chief Mate Gerry Parlon, and 3rd Mate Chris Murray.



2nd Mate David Haa of the *CSX Tacoma* at the Port of Anchorage. The *Tacoma* recorded 689 BBXX transmissions in 2002, an all time high for this vessel.

Captain Charles Parish (left) and Anchorage PMO Larry Hubble. The *Seabulk Montana* (pictured here) had her best BBXX of all time, increasing observations by 10% over 2001 with a total of 636, and are working to best even that for 2003.

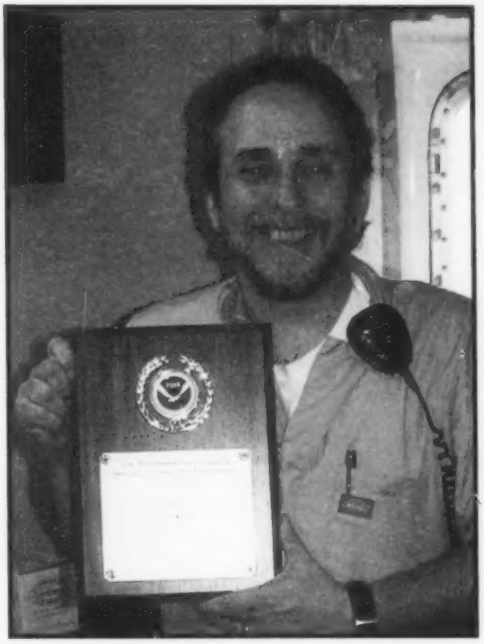
NOAA Ship Albatross IV:
(left to right)
LCDR Philip Gruccio, XO and
LTJG John Crofts, Navigator

M.V. APL Japan Officers
onboard 3rd June 2003: (left to
right)
Chief Office Kumar, 2nd Officer
Mogan, Captain S.K. Menon, and
3rd Officer Aathony

Atlantic Cartier: (left to right)
2nd Officer Richel Nufable, Captain Michael
Lundquist, 2nd Officer Richard Dollete, and
2nd Officer Fred Robante

Courtney L: (left to right) 3rd Officer C. Townsell,
Captain A.J. Wilson, and 2nd Officer
P. Alejandro. (photo by Jim Saunders, PMO Baltimore)

M/V Edgar B Speer: (left to right) Captain Larry Stolz, 2nd Mate Richard Robertson, 3rd Mate James Bittner, 1st Mate Bruce Doyle

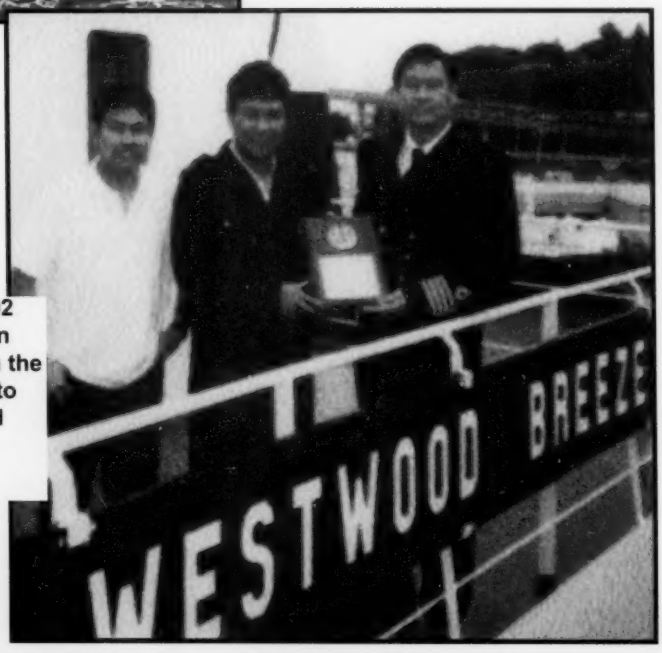


M/V Endeavor: Chief Mate Kevin Quinn

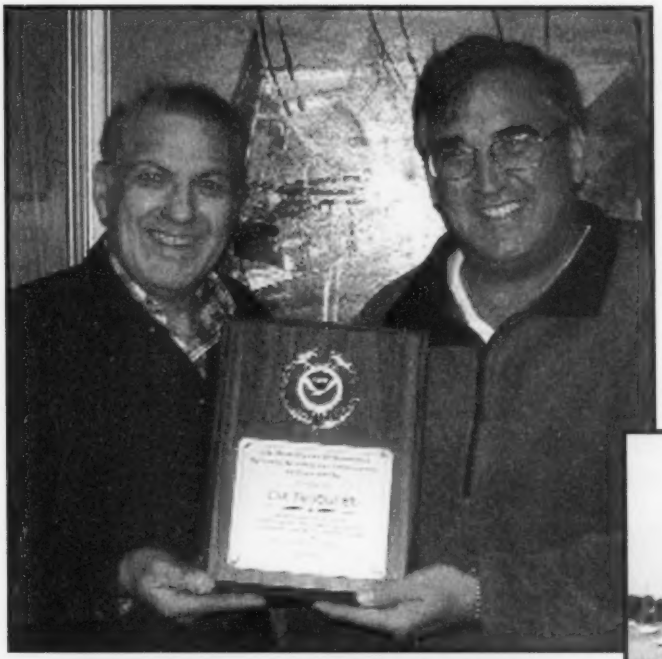
R/V Maurice Ewing: (left to right) Captain Mark Landow, PMO Tim Kenefick, and Port Engineer Al Walsh at the Lamont-Doherty Observatory. (Photo by Mercy Garland)

Fidelio: Captain Langford (right) being presented a 2002 VOS Award by Baltimore PMO James Saunders

NOAA Ship Gordon Gunter (left)
Above photo: (left to right) PMO John Warrelmann, Lt. Joe Pica, Commander Jon Rix, Ensign Pat Didier, 3rd Mate Miri Skoriak, and Ensign Lindsay Kurelja

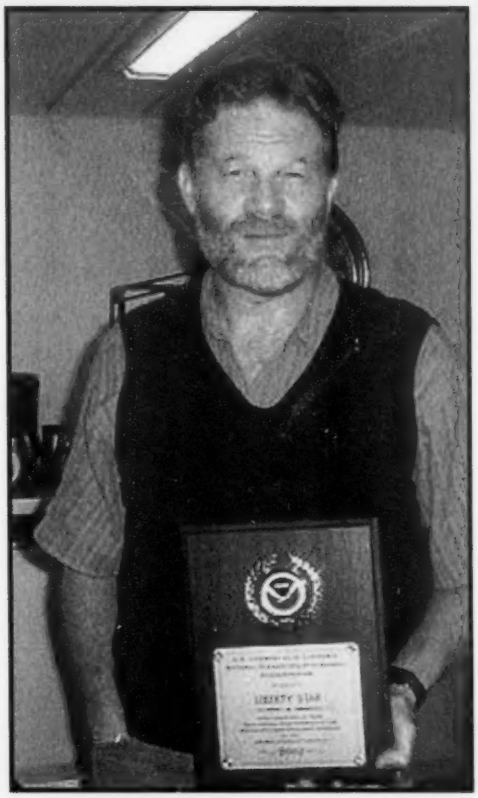


The *Westwood Breeze* was awarded a 2002 VOS Award for their oustanding support in taking weather observations enroute from the West Coast to the Far East. Pictured left to right are 3rd Mate Rodelo Lumanglas, 2nd Mate Jaena Felipe, and Captain Robert Montenegro.



***CSX Horizon Producer*: Wally Becker, Horizon Lines Marine Operations, and Captain Don Cocozza, Master. Captain Bill Boyce was unavailable at the time the VOS Award was presented.**

***NOAA Ship Delaware II* (left to right)Ensign Bryan Waggonseller, and Master Stephen Wagner**



Master Bruce C. McMullen of the *Liberty Star*

Captain David Gammons and 2nd Mate Marlon Ruelan of the *Saudi Hofuf*.

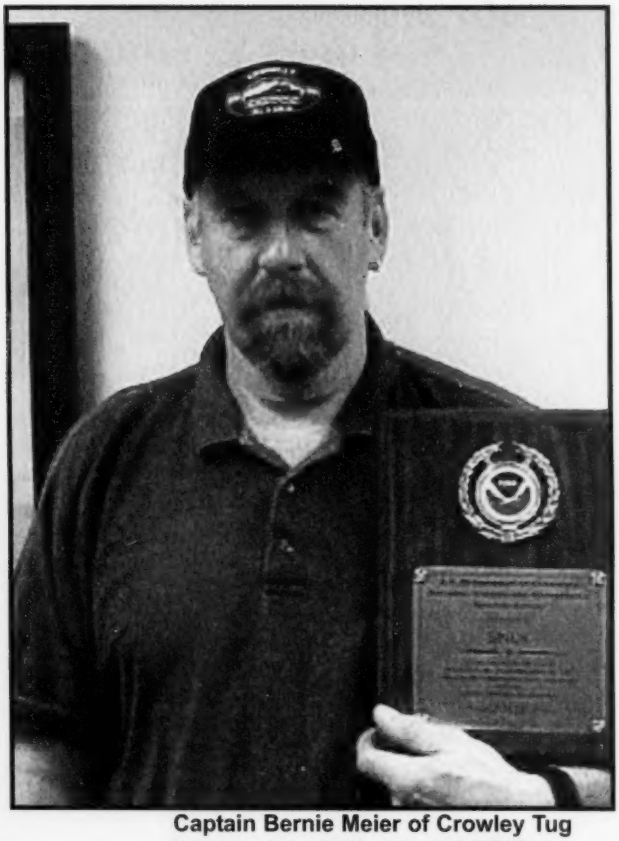
Lykes Explorer: (left to right) Chief Mate Joe "Cool" Single, Captain Bob Febos, and Chief Mate Beth O'Brien.

NOAA Ship Oregon II (shown here) with PMO John Warrelmann, Lt. Keith W. Roberts, 3rd Mate David M. Nelson, and Commander Todd C. Stiles.

President Truman: (left to right) Cadet Adam Richardson, Captain Steve Wilson, Captain James Harney, 2nd Mate Mark Schidermayer, and 3rd Mate Eric Erving

Aboard the *Tellus* are PMO Baltimore James Saunders, presenting a 2002 VOS Award to 2nd Officer Riccardo Giannone, and Captain Ken Bagley.

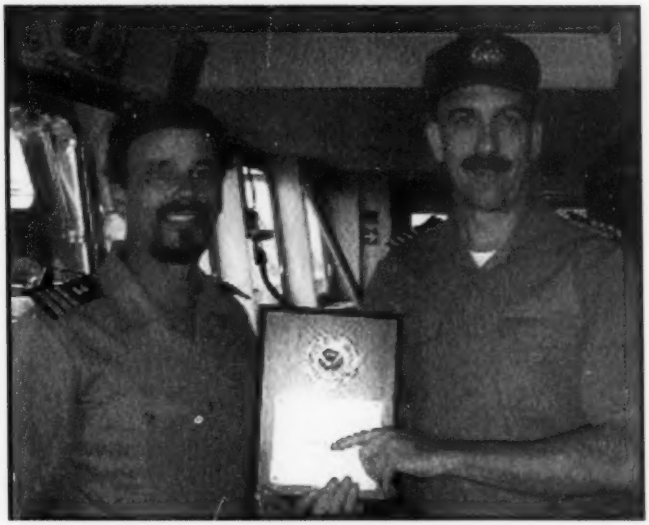
Captain Thomas Thoens (second from left) with Corpus Christi PMO Larry Maifeld and mates (far left) Oliver Sherwin and (far right) Kris Werner of the *Overseas New Orleans* receiving their 2002 VOS Award.



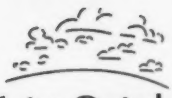
Captain Bernie Meier of Crowley Tug *Sinuk* in July 2002 with 440 BBXX for 2002, and already having doubled that for this year.

President Adams: (left to right) 2nd Mate Carl Rice, Master Dennis Carney, and Radio Officer Michel Frank

Chief Mate John Muir and Captain Kevin O'Halloran of the *Sealand Motivator*



***Strong Patriot* Captain Lou Moglia, Chief Mate Dan Lopez, 2nd Mate Keith Stribley, and 3rd Mate Jim Cochran**

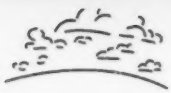


VOS Cooperative Ship Report May 1 to October 31, 2003

The values under the monthly colums represent the number of weather reports received at NCDC. The current month plus the previous 3-4 month's numbers reflect real-time observations plus the delayed mode observations as they are received and entered.

Ship Name	Call	Port	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	TOTAL
JAG PRAKASH	AUBK	Anchorage	0	0	0	0	0	76	60	87	47	2	272
POLAR EAGLE	ELPT3	Anchorage	100	75	107	89	32	117	171	175	176	207	1249
ARCTIC SUN	ELQB8	Anchorage	92	92	106	97	89	86	153	201	195	199	1310
HORIZON ANCHORAGE	KGTX	Anchorage	60	61	94	89	91	82	72	75	47	39	710
HORIZON TACOMA	KGTY	Anchorage	37	43	79	87	63	87	80	66	48	65	655
HORIZON KODIAK	KGTZ	Anchorage	66	52	100	60	42	20	33	80	60	51	564
LYKES EAGLE	VSUA7	Anchorage	10	7	0	0	0	0	0	0	7	3	27
AGRIUM	WAB930	Anchorage	53	29	38	48	38	41	21	2	0	0	270
OCEAN RANGER	WAM7635	Anchorage	2	0	0	0	0	0	0	0	5	5	12
PANDALUS	WAV7611	Anchorage	0	0	0	1	22	0	0	0	0	0	23
WESTERN NAVIGATOR	WAX7602	Anchorage	0	0	0	0	0	4	7	9	5	17	42
GALE WIND	WAZ9548	Anchorage	12	3	9	1	5	12	18	7	13	11	91
POINT BARROW	WBM5088	Anchorage	0	0	0	0	0	0	3	1	13	0	17
SEA RANGER	WBM8733	Anchorage	0	0	0	0	14	16	20	20	34	0	104
PT. THOMPSON	WBN5092	Anchorage	0	0	0	0	0	3	26	10	6	35	80
GUARDSMAN	WBN5978	Anchorage	0	0	0	0	0	0	36	6	0	2	44
GLADIATOR	WBN5982	Anchorage	0	0	0	0	0	0	2	0	0	0	2
SIOUX	WBN7617	Anchorage	2	0	0	0	0	10	0	0	0	0	12
SENECA	WBN8469	Anchorage	0	0	0	0	36	135	187	146	161	80	745
GUARDIAN	WBO2511	Anchorage	0	0	0	1	69	198	103	80	49	32	532
NAVIGATOR	WBO3345	Anchorage	44	68	100	113	15	36	66	58	55	67	622
SEA VENTURE	WCC7684	Anchorage	14	0	1	0	0	10	0	0	44	19	88
SEA VIKING	WCE8951	Anchorage	7	0	0	0	0	14	0	0	70	1	92
OCEAN MARINER	WCF3990	Anchorage	0	0	0	0	14	8	2	0	0	13	37
REDOUBT	WCG3013	Anchorage	1	0	0	0	0	10	0	3	6	9	29
SIKU	WCQ6174	Anchorage	0	0	0	0	3	2	0	0	1	11	17
SINUK	WCQ8110	Anchorage	0	0	0	95	162	220	162	152	139	88	1018
CROSS POINT	WCW8728	Anchorage	0	0	0	0	0	1	0	0	0	0	1
SEABULK MONTANA	WCW9126	Anchorage	84	91	52	97	102	44	98	29	22	62	681
SEA VICTORY	WCY6777	Anchorage	31	0	0	0	0	13	0	0	0	1	45
TAN'ERLIQ	WCY8497	Anchorage	1	0	0	0	0	0	0	0	0	0	1
PACIFIC TITAN	WCZ6844	Anchorage	0	0	0	0	0	0	0	3	3	0	6
ISLAND CHAMPION	WCZ7046	Anchorage	0	0	0	0	0	0	1	0	0	5	6
PT BROWER	WDA2796	Anchorage	0	0	0	0	0	1	233	170	0	0	404
GULF TITAN	WDA5598	Anchorage	0	0	0	0	0	0	0	0	0	11	11
ISLAND WARRIOR	WDA9217	Anchorage	0	0	0	0	0	0	0	4	10	12	26
NORTHERN LIGHTS	WFJK	Anchorage	64	4	2	0	2	0	0	0	0	0	72
TYONEK	WMH8	Anchorage	13	10	12	11	6	5	13	1	0	0	71
ALASKA MARINER	WSM5364	Anchorage	0	3	0	0	0	3	5	0	13	0	24
KENAI	WSNB	Anchorage	7	0	0	0	0	0	3	6	0	0	16
BRUCE	WWU8	Anchorage	25	33	23	30	39	39	34	37	40	43	343
R/V TIGLAX	WZ3423	Anchorage	0	0	0	0	1	1	8	15	15	0	40
Anchorage Ships: 43			725	571	723	819	845	1294	1617	1443	1284	1090	10411
MAERSK TAIKI	9VIG	Baltimore	0	0	0	0	0	0	28	61	0	25	114
EVER GENERAL	BKHY	Baltimore	15	0	0	0	0	0	0	0	0	0	15
M/T SUN VOYAGER	C6FD3	Baltimore	37	0	8	0	0	4	41	26	21	72	209
CAPELLA VOYAGER	C6FD4	Baltimore	32	31	79	32	17	2	13	17	25	15	263
GALAXY	C6FU6	Baltimore	0	0	0	0	0	0	12	11	9	12	44

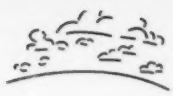
Ship Name	Call	Port	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	TOTAL
CHIQUITA SCANDINAVIA	C6KD4	Baltimore	52	49	63	54	62	70	68	72	67	48	605
CHIQUITA ITALIA	C6KD5	Baltimore	0	0	5	43	50	52	51	53	51	65	370
CHIQUITA NEDERLAND	C6KD6	Baltimore	53	41	55	48	58	47	51	35	39	51	478
CHIQUITA BELGIE	C6KD7	Baltimore	60	46	45	45	43	49	24	28	35	50	425
CHIQUITA DEUTSCHLAND	C6KD8	Baltimore	79	54	59	34	66	65	60	64	62	69	612
CHIQUITA SCHWEIZ	C6KD9	Baltimore	56	46	43	45	51	55	56	46	50	57	505
ORION VOYAGER	C6MC5	Baltimore	13	12	18	37	37	28	50	33	14	15	257
TROJAN STAR	C6OD7	Baltimore	43	13	69	64	0	0	0	0	41	76	306
ALTAIR VOYAGER	C6OK	Baltimore	0	14	14	9	16	33	15	9	13	12	135
EDYTH L	C6YC	Baltimore	71	47	52	42	41	28	19	21	34	17	372
FRANCES L	C6YE	Baltimore	34	24	79	36	48	57	74	61	46	40	499
HADERA	ELBX4	Baltimore	41	28	50	14	48	6	0	18	93	12	310
OURO DO BRASIL	ELPP9	Baltimore	7	1	21	45	38	74	69	76	36	0	367
SOL DO BRASIL	ELQQ4	Baltimore	22	48	0	0	0	32	37	41	37	53	270
PITTSBURG	ELTQ6	Baltimore	69	60	67	54	59	59	64	58	57	62	609
SAUDI ABHA	HZRX	Baltimore	82	46	48	58	66	44	63	19	67	62	555
MAERSK ALASKA	KAKF	Baltimore	29	39	0	0	35	49	36	0	25	39	252
MAERSK ARIZONA	KAKG	Baltimore	2	0	5	32	39	18	8	0	6	10	120
STAR HARMONIA	LAGB5	Baltimore	14	32	1	5	32	28	11	21	0	1	145
STAR ISMENE	LANT5	Baltimore	0	38	8	42	27	33	28	43	34	35	288
STAR HERDLA	LAVD4	Baltimore	31	67	15	36	40	23	48	48	29	1	338
STAR HIDRA	LAVN4	Baltimore	0	10	62	2	15	23	0	17	28	0	157
STAR ALABAMA	LAVU4	Baltimore	0	0	21	0	0	0	0	18	48	0	87
STAR EAGLE	LAWO2	Baltimore	51	87	32	69	33	33	19	30	0	38	392
TREIN MAERSK	MSQQ8	Baltimore	24	0	0	10	0	22	25	25	12	10	128
ANKERGRACHT	PCQL	Baltimore	34	29	47	9	53	26	47	34	0	0	279
APOLLOGRACHT	PCSV	Baltimore	38	32	19	24	27	5	1	0	0	0	146
STAR INDIANA	S6BE	Baltimore	0	0	0	0	0	0	44	0	41	25	110
FIGARO	S6PI	Baltimore	58	8	0	0	0	0	0	0	0	0	66
MAERSK WIND	S6TY	Baltimore	0	0	0	0	0	0	0	0	2	16	18
ENERGY ENTERPRISE	WBJF	Baltimore	0	0	0	0	0	0	0	0	16	0	16
TANABATA	WCZ5535	Baltimore	45	28	17	33	36	15	21	34	31	33	293
GREEN LAKE	WDDI	Baltimore	20	0	0	0	42	21	37	29	10	11	170
FIDELIO	WQVY	Baltimore	52	22	130	56	45	33	44	55	58	61	556
TELLUS	WRYG	Baltimore	33	4	107	0	60	0	29	31	36	11	311
FAUST	WRYX	Baltimore	48	52	66	46	55	28	50	2	0	18	365
PRIDE OF BALTIMORE II	WUW2120	Baltimore	0	0	0	0	38	73	25	39	39	21	235
GLOBAL LINK	WWDY	Baltimore	0	0	0	0	0	0	0	2	0	0	2
ITB BALTIMORE	WXKM	Baltimore	11	29	23	0	8	11	0	0	21	9	112
GYPSUM KING	ZCAN2	Baltimore	0	0	0	13	0	0	0	0	0	0	13
COURTNEY L	ZCAQ8	Baltimore	0	0	0	18	27	8	10	24	29	19	135
SKODSBORG	ZCIJ7	Baltimore	0	0	0	0	0	0	0	0	8	17	25
Baltimore Ships: 47			1256	1037	1328	1055	1312	1154	1278	1201	1270	1188	12079
SPIRIT OF OCEANUS	C6PJ8	Kodiak	0	0	0	0	0	4	5	0	0	0	9
ATLANTIS	KAQP	Kodiak	0	0	2	4	0	0	0	0	0	3	9
OVERSEAS CHICAGO	KBCF	Kodiak	0	1	0	0	0	0	0	0	0	0	1
TONSINA	KJDG	Kodiak	24	19	23	8	22	20	16	2	2	4	140
SARATOGA	KL0YL	Kodiak	0	0	20	28	26	38	32	10	0	2	156
OVERSEAS BOSTON	KRDB	Kodiak	16	8	0	0	0	0	23	32	11	2	92
RED DOG	KYU625	Kodiak	0	0	0	0	0	0	0	20	0	0	20



Ship Name	Call	Port	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	TOTAL
USCGC JARVIS	NAQD	Kodiak	0	0	0	1	0	0	0	0	0	0	1
USCGC SPAR	NJAR	Kodiak	0	0	0	1	0	0	1	0	0	0	2
USCGC RUSH	NLVS	Kodiak	0	0	0	0	0	14	39	34	0	0	87
USCGC ACUSHNET WMEC 167	NNHA	Kodiak	2	0	0	12	1	3	0	0	0	0	18
USCGC FIREBUSH WLB 393	NODL	Kodiak	0	0	1	0	0	0	0	0	0	0	1
USCGC STORIS (WMEC 38)	NRUC	Kodiak	0	0	20	1	13	25	72	7	0	0	138
USCGC ALEX HALEY	NZPO	Kodiak	0	1	0	0	0	0	0	0	0	2	3
GEMINI	V7BW9	Kodiak	17	3	0	0	0	0	0	0	0	25	45
NORTHERN SPIRIT	WAQ2746	Kodiak	10	14	20	17	34	43	55	55	63	24	335
VIKING STAR	WAS4138	Kodiak	8	3	0	1	4	0	0	0	3	2	21
TITAN	WAW9232	Kodiak	14	7	0	0	0	0	1	8	17	10	57
NATOMA	WBB5799	Kodiak	5	0	0	6	0	0	0	4	0	3	18
BLARNEY	WBP4766	Kodiak	1	4	1	1	23	23	19	2	21	62	157
COASTAL PILOT	WBP7281	Kodiak	2	0	6	0	0	0	0	0	0	0	8
RESOLUTION	WBR6941	Kodiak	0	0	0	1	0	1	0	0	0	0	2
DAVID BRUSCO	WBT4608	Kodiak	0	0	0	0	0	2	0	0	0	0	2
ZENITH	WBV3237	Kodiak	1	0	1	0	1	4	0	1	1	1	10
SAMSON MARINER	WCN3586	Kodiak	13	3	2	4	6	5	11	1	5	1	51
MICHAEL O'LEARY	WCP9556	Kodiak	0	0	0	0	0	0	0	1	2	0	3
NAVAJO	WCT5737	Kodiak	0	0	11	2	0	10	9	0	1	2	35
GYR FALCON	WCU6587	Kodiak	2	0	0	0	0	1	0	0	3	0	6
JEFFREY FOSS	WCX4608	Kodiak	0	0	0	0	0	0	4	0	1	20	25
STIMSON	WCY2270	Kodiak	0	0	20	19	34	16	9	0	6	60	164
WOLDSTAD	WCY2271	Kodiak	0	0	24	37	15	41	8	0	0	29	154
CHINOOK	WCY2791	Kodiak	0	0	0	0	0	0	0	4	0	0	4
GRETA	WCY2853	Kodiak	0	0	0	0	23	4	0	10	22	31	90
KENNICOTT	WCY2920	Kodiak	24	32	49	52	50	13	51	91	59	45	466
COASTAL EXPLORER	WCY3172	Kodiak	0	0	0	5	1	17	16	7	6	1	53
DAVIDSON	WCY3880	Kodiak	0	0	0	0	0	0	0	72	26	0	98
IVER FOSS	WCY6442	Kodiak	0	0	0	0	0	2	0	0	0	4	6
SEABULK PRIDE	WCY7052	Kodiak	0	0	37	64	45	41	82	23	45	28	365
SEABULK ARCTIC	WCY7054	Kodiak	0	0	0	0	0	0	11	3	5	22	41
TRIDENT	WCZ2913	Kodiak	0	2	5	8	9	2	8	5	11	1	51
NORTHERN VICTOR	WCZ6534	Kodiak	6	0	0	15	0	6	0	0	0	5	32
M/V NORTHWEST EXPLORER	WCZ9007	Kodiak	0	0	0	0	0	0	4	0	0	0	4
PARAGON	WDA2311	Kodiak	25	40	32	0	19	51	41	64	66	95	433
PACIFIC CHALLENGER	WDA3588	Kodiak	0	0	0	0	5	19	13	42	56	104	239
PHYLLIS DUNLAP	WDA6552	Kodiak	0	9	3	2	11	5	3	2	2	8	45
LAUREN FOSS	WDB3834	Kodiak	0	0	0	0	0	0	60	37	0	3	100
PACIFIC FREEDOM	WDJF	Kodiak	0	0	5	9	0	0	15	25	22	3	79
TAKU	WI9491	Kodiak	20	10	5	0	10	3	1	0	0	0	49
OVERSEAS NEW YORK	WMCK	Kodiak	2	0	0	0	0	0	0	0	0	0	2
MATANUSKA	WN4201	Kodiak	0	1	22	1	0	31	49	75	0	0	179
TUSTUMENA	WNGW	Kodiak	0	0	0	9	27	109	109	80	121	90	545
BLUEFIN	WQZ9646	Kodiak	0	0	0	1	0	2	3	0	5	2	13
FISHHAWK	WRB5085	Kodiak	0	0	0	0	0	0	0	6	10	8	24
RHEA BOUCHARD	WRQ4509	Kodiak	0	0	0	0	0	0	0	0	1	0	1
R.V. DAY	WS6709	Kodiak	0	0	0	0	2	0	1	0	0	0	3
ALPHA HELIX	WSD7078	Kodiak	0	0	7	9	11	4	14	14	8	4	71
COASTAL TRADER	WSL8560	Kodiak	0	4	0	0	1	1	0	1	0	0	7
BOWFIN	WSX7318	Kodiak	0	0	1	0	2	0	0	2	1	4	10
LOIS H.	WTD4576	Kodiak	0	0	0	0	0	0	1	0	1	0	2
YELLOWFIN	WTE8342	Kodiak	0	0	0	0	0	0	0	1	0	0	1
REDFIN	WTP2735	Kodiak	2	0	0	1	2	1	0	0	2	1	9
CAPT LES EASON	WTT8587	Kodiak	0	0	2	4	0	0	4	2	0	0	12
MIKI HANA	WTW9252	Kodiak	0	0	1	4	0	0	12	0	0	0	17
HENRY SAUSE	WTW9259	Kodiak	0	0	1	4	0	0	6	1	0	1	13
ROUGHNECK	WTW9262	Kodiak	0	0	2	6	10	3	15	3	7	12	58

Ship Name	Call	Port	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	TOTAL
OCEAN SERVICE	WTW9263	Kodiak	7	5	0	6	7	10	12	0	0	0	47
ROBERT L.	WTW9264	Kodiak	0	4	7	0	0	2	1	3	0	6	23
POWHATTAN	WTX7883	Kodiak	0	0	0	0	2	3	2	0	4	0	11
AMERICAN NO. 1	WTY8664	Kodiak	0	0	0	0	1	0	0	0	0	0	1
DIANE H.	WUR7250	Kodiak	0	0	0	1	18	5	42	12	1	8	87
SALISHAN	WUT4384	Kodiak	0	2	11	11	7	0	2	0	0	0	33
E.L. BARTLETT	WY6244	Kodiak	1	0	0	0	6	18	55	18	33	0	131
MALOLO	WYH6327	Kodiak	56	19	21	42	60	125	141	142	131	72	809
TAURUS	WYH6499	Kodiak	0	0	0	0	0	2	46	11	0	0	59
SANDRA FOSS	WYL4908	Kodiak	0	0	20	20	26	9	0	0	1	17	93
STACEY FOSS	WYL4909	Kodiak	0	0	0	0	0	9	0	0	0	13	22
JUSTINE FOSS	WYL4978	Kodiak	14	15	14	13	3	4	7	7	2	10	89
SIDNEY FOSS	WYL5445	Kodiak	0	5	2	25	14	6	30	7	15	32	136
NORMA H.	WYL6686	Kodiak	0	0	0	0	0	0	0	0	6	0	6
AURORA	WYM9567	Kodiak	0	0	0	0	0	10	6	0	3	31	50
NORCOASTER	WYP7276	Kodiak	0	0	0	0	0	0	1	0	2	1	4
COLUMBIA	WYR2092	Kodiak	0	0	0	0	3	11	1	7	1	0	23
AGNES FOSS	WYZ3112	Kodiak	5	1	4	17	9	7	13	13	30	15	114
LECONTE	WZE4270	Kodiak	23	0	0	1	1	1	0	0	0	0	26
Kodiak Ships: 84			300	212	402	473	564	786	1182	967	841	929	6656

Ship Name													
ALLIGATOR STRENGTH	3FAK5	Oakland	0	0	0	0	0	0	0	0	0	1	1
BOSPORUS BRIDGE	3FMV3	Oakland	66	36	0	0	0	0	0	0	0	0	102
MOL BRAVERY	3FXX4	Oakland	0	0	4	0	0	0	0	0	0	0	4
APL GARNET	9VVN	Oakland	32	30	20	0	5	0	8	2	0	0	97
MOL INNOVATION	9VVP	Oakland	37	15	11	19	16	0	3	0	0	44	145
APL TURQUOISE	9VVY	Oakland	42	37	49	43	27	54	15	32	44	36	379
RAYMOND E. GALVIN	C6FD6	Oakland	18	0	0	0	0	0	0	0	0	0	18
RICHARD H MATZKE	C6FE5	Oakland	13	5	25	44	61	50	12	30	60	11	311
CHANG-LIN TIEN	C6FE6	Oakland	4	7	0	0	0	0	0	0	0	0	11
FRANK A. SHRONTZ	C6PZ3	Oakland	27	38	117	53	37	9	5	45	39	60	430
J. BENNETT JOHNSTON	C6QE3	Oakland	2	5	0	0	11	6	0	0	0	0	24
DIRECT JABIRU	ELYJ9	Oakland	0	0	70	0	17	0	0	0	0	0	87
SETO BRIDGE	JMQY	Oakland	57	32	21	57	55	45	41	49	27	0	384
MANOA	KDBG	Oakland	30	34	26	36	44	60	39	35	43	66	413
CHEVRON WASHINGTON	KFDB	Oakland	0	1	4	8	0	19	0	3	17	2	54
SEA-LAND DEFENDER	KGJB	Oakland	46	30	50	51	49	52	57	57	36	65	493
MATSONIA	KHRC	Oakland	22	26	21	19	31	11	2	9	9	18	168
SEALAND PATRIOT	KHRF	Oakland	35	41	48	24	23	50	42	31	54	57	405
SEALAND LIBERATOR	KHRP	Oakland	45	50	40	41	51	46	54	64	41	49	481
CSX TRADER	KIRH	Oakland	27	15	33	36	36	45	32	42	27	64	357
MARINE COLUMBIA	KLKZ	Oakland	72	66	68	61	47	116	72	48	48	59	657
MANULANI	KNIJ	Oakland	0	0	0	0	0	10	20	0	0	1	31
CSX ENTERPRISE	KRGB	Oakland	57	62	149	27	18	75	77	70	69	85	689
STRONG VIRGINIAN	KSPH	Oakland	47	68	78	86	77	32	15	37	42	77	559
USCGC SHERMAN	NMMJ	Oakland	0	0	62	34	0	9	0	0	0	0	105
GOLDEN BEAR	NMRY	Oakland	0	0	0	13	75	62	87	41	0	2	280
MADISON MAERSK	OVJB2	Oakland	0	0	10	27	27	17	35	41	52	38	247
MAYVIEW MAERSK	OWEB2	Oakland	24	8	8	31	2	44	21	46	14	48	246
SEALAND CHAMPION	V7AM9	Oakland	49	62	33	65	52	40	34	36	10	0	381
SEALAND MERCURY	V7AP6	Oakland	38	39	115	22	24	21	52	46	35	4	396
OOCL HONG KONG	VRVA5	Oakland	21	20	5	14	8	39	32	48	33	36	256
MOKU PAHU	WBWK	Oakland	6	16	35	6	6	42	59	19	45	31	265
GREEN COVE	WCZ9380	Oakland	0	0	0	0	0	1	17	21	13	1	53



Ship Name	Call	Port	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	TOTAL
CHIEF GADAO	WEZD	Oakland	23	19	81	30	42	20	27	39	28	26	335
HORIZON SPIRIT	WFLG	Oakland	52	53	34	49	58	54	44	56	71	74	545
SEALAND INNOVATOR	WGKF	Oakland	52	53	47	33	66	50	50	56	59	62	528
MAHIMAHI	WHRN	Oakland	61	49	53	41	61	41	36	44	34	37	457
LURLINE	WLVD	Oakland	18	19	62	16	29	45	42	36	0	1	268
MOKIHANA	WNRD	Oakland	64	40	30	47	55	32	32	58	38	39	435
PRESIDENT KENNEDY	WRYE	Oakland	58	44	50	0	0	0	0	0	0	0	152
LIHUE	WTST	Oakland	67	60	249	48	61	94	78	57	56	18	788
Oakland Ships: 41			1212	1080	1708	1081	1171	1291	1140	1198	1044	1112	12037
KIYI	KAO107	Chicago	0	0	0	0	0	0	2	11	5	10	28
SOUTHDOWN CHALLENGER	WA4659	Chicago	0	0	0	13	20	16	11	18	12	25	115
SUSAN W. HANNAH	WAH9146	Chicago	0	0	0	0	0	0	1	6	6	4	17
OGLEBAY NORTON	WAQ3521	Chicago	2	0	0	1	2	1	0	1	0	0	7
SS BADGER	WBD4889	Chicago	0	0	0	0	0	15	12	5	14	3	49
KAREN ANDRIE	WBS5272	Chicago	0	0	0	3	1	1	1	7	4	3	20
INLAND SEAS	WCJ6214	Chicago	0	0	0	0	0	1	3	4	0	0	8
JACKLYN M.	WCV7620	Chicago	7	0	7	13	9	12	14	5	16	17	100
REBECCA LYNN	WCW7977	Chicago	1	0	1	12	18	12	27	12	7	15	105
JOSEPH L. BLOCK	WDA2768	Chicago	5	0	0	1	0	0	0	0	0	0	6
WILFRED SYKES	WDA2769	Chicago	0	0	0	11	13	14	9	11	5	7	70
STEWART J. CORT	WDB4570	Chicago	0	0	0	0	0	0	0	0	9	25	34
PHILIP R. CLARKE	WE3592	Chicago	0	0	0	10	3	4	12	1	5	9	44
JOHN G. MUNSON	WE3806	Chicago	6	0	19	6	3	8	17	12	0	4	75
ARTHUR M. ANDERSON	WE4805	Chicago	4	0	0	0	9	8	12	22	27	44	126
CASON J. CALLAWAY	WE4879	Chicago	46	0	0	1	2	39	0	0	66	46	200
RESERVE	WE7207	Chicago	0	0	0	1	3	0	0	0	0	0	4
BURNS HARBOR	WQZ7049	Chicago	0	0	0	18	19	14	24	0	0	0	75
EDGAR B. SPEER	WQZ9670	Chicago	14	3	3	23	52	35	49	161	130	102	572
MICHIGAN	WRB4141	Chicago	0	3	0	1	5	3	1	2	4	0	19
COLUMBIA STAR	WSB2018	Chicago	0	0	0	0	0	24	20	4	0	0	48
BARBARA ANDRIE	WTC9407	Chicago	2	0	0	1	2	1	0	4	2	1	13
LEE A. TREGURTHA	WUR8857	Chicago	0	0	0	0	0	1	0	0	0	0	1
INDIANA HARBOR	WXN3191	Chicago	10	0	0	6	135	91	138	59	23	0	462
EDWIN H. GOTT	WXQ4511	Chicago	0	0	0	11	2	1	1	0	4	0	19
JAMES R. BARKER	WYP8657	Chicago	1	0	0	52	19	13	14	46	47	70	262
MESABI MINER	WYQ4356	Chicago	3	0	0	0	1	1	4	0	0	33	42
PAUL R. TREGURTHA	WYR4481	Chicago	0	0	0	9	15	23	75	51	51	52	276
STEWART J. CORT	WYZ3931	Chicago	0	0	0	17	6	19	30	13	0	0	85
JOHN J. BOLAND	WZE4539	Chicago	0	0	0	0	0	0	0	0	8	4	12
PRESQUE ISLE	WZE4928	Chicago	0	0	0	1	5	24	87	123	64	57	361
EARL W. OGLEBAY	WZE7718	Chicago	0	0	0	0	0	0	0	0	2	1	3
ROGER BLOUGH	WZP8164	Chicago	0	0	0	33	25	11	23	41	10	34	177
Chicago Ships: 33			101	6	30	244	369	392	587	619	521	566	3435
NOAA SHIP KA'IMIMOANA	WTEU	Honolulu	69	44	16	70	31	68	83	51	82	52	566
Honolulu Ships: 1													

Ship Name	Call	Port	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	TOTAL
MACKINAC BRIDGE	JKES	Newark	0	31	24	49	28	56	44	44	42	46	364
OLEANDER	PJJU	Newark	9	0	0	0	0	1	0	0	2	0	12
Newark Ships: 2			9	31	24	49	28	57	44	44	44	46	376
MAERSK TAIYO	9VJO	Jacksonville	0	0	25	46	56	0	0	0	19	11	157
HUAL TRANSPORTER	C6QO3	Jacksonville	0	0	0	0	0	0	0	0	3	0	3
SEALAND ARGENTINA	DGVN	Jacksonville	27	3	48	1	39	59	86	60	0	0	323
SOLAR WING	ELJS7	Jacksonville	98	22	97	82	89	93	105	99	86	82	853
FRONTIER ACE	H3CM	Jacksonville	0	0	0	0	0	0	0	30	0	2	32
HARMONY ACE	H3QA	Jacksonville	24	18	35	73	38	44	28	22	16	26	324
STAR EVVIVA	LAHE2	Jacksonville	24	0	18	0	0	0	0	0	0	0	42
TALISMAN	LAOW5	Jacksonville	17	6	0	28	20	0	0	0	0	11	82
STAR AMERICA	LAVV4	Jacksonville	38	0	24	30	23	44	29	38	27	1	254
STAR HANSA	LAXP4	Jacksonville	24	0	6	7	4	1	15	1	1	0	59
USNS 1ST LT. HARRY L. MA	NDFH	Jacksonville	13	0	0	0	0	0	0	0	0	0	13
GREEN DALE	WCZ5238	Jacksonville	14	19	43	7	6	30	35	44	25	41	264
KILO MOANA	WDA7827	Jacksonville	0	0	0	79	97	38	64	40	38	53	409
EL YUNQUE	WGJT	Jacksonville	6	7	10	28	20	7	11	7	10	34	140
1ST LT BALDOMERO LOPEZ	WJKV	Jacksonville	0	0	0	0	0	0	0	0	2	0	2
RICHARD G MATTHIESEN	WLBV	Jacksonville	10	0	0	0	0	0	0	0	0	0	10
HORIZON EXPEDITION	WPGJ	Jacksonville	59	49	85	82	43	49	64	0	0	1	432
OVERSEAS JOYCE	WUQL	Jacksonville	16	24	21	9	11	19	19	19	22	22	182
HORIZON CHALLENGER	WZJC	Jacksonville	21	8	46	53	54	66	52	102	107	76	585
HORIZON DISCOVERY	WZJD	Jacksonville	0	0	0	53	55	56	51	70	68	56	409
CHIQUITA JEAN	ZCBB7	Jacksonville	0	0	0	5	9	50	0	0	0	0	64
Jacksonville Ships: 21			391	156	458	583	564	556	559	532	424	416	4639
CARNIVAL VICTORY	3FFL8	Miami	24	26	60	17	11	14	9	3	3	10	177
CARIBBEAN MERCY	3FFU4	Miami	13	0	0	6	0	0	11	0	0	0	30
CARNIVAL PARADISE	3FOB5	Miami	0	1	0	2	0	28	29	12	18	26	116
ELATION	3FOC5	Miami	22	15	0	0	0	0	0	0	0	0	37
CARNIVAL SPIRIT	3FPR9	Miami	0	3	0	0	0	0	0	0	0	0	3
ZIM KOREA	4XGU	Miami	0	0	0	0	13	0	21	58	0	0	92
ANASTASIS	9HOZ	Miami	18	30	0	0	0	0	0	0	0	0	48
NORWAY	C6CM7	Miami	23	2	0	20	39	0	0	0	0	0	84
FASCINATION	C6FM9	Miami	9	7	9	5	6	0	4	3	4	0	47
CARNIVAL TRIUMPH	C6FN5	Miami	27	30	38	38	39	34	15	1	2	0	224
DUNCAN ISLAND	C6JS	Miami	67	51	47	44	51	39	39	30	47	27	442
CHARLES ISLAND	C6JT	Miami	38	31	4	3	2	1	0	2	1	1	83
HOOD ISLAND	C6LU4	Miami	0	0	6	29	29	23	17	50	50	43	247
BARRINGTON ISLAND	C6QK	Miami	37	14	14	20	21	17	13	5	8	7	156
CELTIC SEA	C6RT	Miami	0	0	0	45	37	49	36	45	65	39	316
MERCURY	C6SQ6	Miami	0	0	1	0	1	0	0	0	0	0	2
CORAL SEA	C6YW	Miami	38	34	0	0	0	0	0	0	0	0	72
CROWLEY UNIVERSE	ELRU3	Miami	0	0	6	0	0	0	0	0	0	0	6
EXPLORER OF THE SEAS	ELWX5	Miami	36	388	430	360	439	414	335	255	365	337	3359
ORIANA	GVSN	Miami	8	6	1	4	22	0	0	0	0	0	41
FANTASY	H3GS	Miami	0	0	0	0	9	6	1	0	0	0	16
CARNIVAL PRIDE	H3VU	Miami	0	0	2	0	0	4	16	18	2	1	43
TROPIC LURE	J8PD	Miami	1	0	1	0	0	0	0	0	0	0	2
EL MORRO	KCGH	Miami	3	0	0	0	0	0	0	0	0	0	3
ARIZONA VOYAGER	KGBE	Miami	0	5	0	0	9	21	23	6	4	0	68
MARIT MAERSK	OZFC2	Miami	23	2	8	15	32	6	28	0	8	15	137
MAASDAM	PFRO	Miami	46	30	3	5	3	0	0	0	3	46	136
NOORDAM	PGHT	Miami	1	0	0	0	0	0	0	0	0	0	1

Ship Name	Call	Port	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	TOTAL
RYNDAM	PHFV	Miami	47	57	48	15	0	0	0	0	0	0	167
STATENDAM	PHSG	Miami	33	7	0	7	6	9	19	5	0	0	86
PROJECT ARABIA	PJKP	Miami	50	26	0	0	0	0	0	0	0	0	76
MEKONG PIONEER	V2JN	Miami	83	76	85	73	71	38	47	76	86	43	678
ITB NEW YORK	WVDG	Miami	0	5	22	15	5	0	2	25	15	5	94
CHIQUITA ELKESCHLAND	ZCBB9	Miami	0	0	0	0	0	0	0	0	16	77	93
CHIQUITA BREMEN	ZCBC5	Miami	0	0	0	15	23	20	36	11	42	49	196
Miami Ships: 35			647	846	785	738	868	723	701	605	739	726	7378
MOL THAMES	3EFV8	Norfolk	0	0	0	0	0	0	0	0	0	21	21
APL ALMANDINE	9VBS	Norfolk	0	0	0	0	0	0	0	8	36	28	72
APL JADE	9VVD	Norfolk	8	4	0	0	0	0	0	0	0	0	12
SEALAND INTREPID	9VWZ	Norfolk	0	0	0	49	11	42	18	50	17	31	218
AMERICA SENATOR	9WCR3	Norfolk	0	0	0	0	0	0	0	0	3	0	3
P&O NEDLLOYD DAMMAM	A8CA3	Norfolk	0	0	0	0	0	0	50	78	67	87	282
RANI PADMINI	ATSR	Norfolk	0	7	0	0	0	0	0	0	0	0	7
ATLANTIC CARTIER	C6MS4	Norfolk	40	38	29	43	51	0	0	0	0	0	201
JOIDES RESOLUTION	D5BC	Norfolk	5	1	0	0	0	6	0	0	29	0	41
CONTI MALACA	DGVZ	Norfolk	0	0	13	25	18	0	41	50	27	20	194
SEA MERCHANT	ELQN2	Norfolk	7	50	1	0	0	0	0	0	0	0	58
MOSEL ORE	ELRE5	Norfolk	62	56	11	12	22	3	55	13	0	0	234
DIRECT TUI	ELVZ5	Norfolk	58	64	37	40	66	32	87	59	78	92	613
CONTSHIP ROME	ELVZ6	Norfolk	31	18	43	36	27	30	0	35	37	17	274
CGM RENOIR	ELVZ8	Norfolk	0	1	0	0	1	0	0	0	0	0	2
EDWARD OLDENDORFF	ELWP2	Norfolk	0	33	0	28	0	0	0	0	0	0	61
STAR GEIRANGER	LAKQ5	Norfolk	34	20	22	25	13	8	28	20	4	26	200
STAR GRINDANGER	LAKR5	Norfolk	85	5	44	34	35	0	31	32	0	38	304
TAMESIS	LAOL5	Norfolk	34	3	20	0	24	18	0	0	12	28	139
USNS GILLILAND	NAMJ	Norfolk	0	0	0	0	0	0	0	0	1	0	1
T/V STATE OF MAINE	NTNR	Norfolk	0	0	0	0	0	3	0	0	0	0	3
COLUMBUS CANADA	P3RD8	Norfolk	40	9	3	1	45	78	68	73	67	54	438
COLUMBUS VICTORIA	P3RF8	Norfolk	58	25	73	82	151	0	1	82	78	69	619
COSCO NORFOLK	P3ZY6	Norfolk	17	9	0	25	18	21	11	5	5	1	112
MARION GREEN	PIAN	Norfolk	39	39	27	2	5	0	0	0	0	0	112
ATLANTIC CARTIER	SCKB	Norfolk	0	0	0	0	0	0	0	0	40	42	82
ORKUN KALKAVAN	TCCG6	Norfolk	0	0	0	0	7	0	0	19	22	20	68
LEYLA KALKAVAN	TCCJ7	Norfolk	0	0	0	32	18	0	0	0	0	1	51
ALKIN KALKAVAN	TCQP	Norfolk	0	0	0	0	0	0	0	0	0	6	6
SELMA KALKAVAN	TCSX	Norfolk	7	56	11	18	26	48	29	18	21	26	260
INDUSTRIAL CRESCENT	V2UD	Norfolk	0	0	0	1	0	0	0	0	0	0	1
SEALAND COMET	V7AP3	Norfolk	59	33	55	3	0	4	18	20	24	2	218
OOCL FORTUNE	VRWF2	Norfolk	38	6	16	30	13	17	18	17	0	0	155
MAERSK VIRGINIA	WAHK	Norfolk	0	0	0	0	0	0	0	0	30	4	34
T/V STATE OF MAINE	WCAH	Norfolk	0	0	0	0	0	1	1	0	0	2	4
GEYSIR	WCZ5528	Norfolk	30	1	14	71	40	105	39	15	39	80	434
STRONG PATRIOT	WCZ8589	Norfolk	5	1	18	39	45	11	4	3	8	15	149
INDUSTRIAL CHALLENGER	WDHL	Norfolk	13	27	0	0	10	2	9	12	3	10	86
2ND LT. JOHN P. BOBO	WJKH	Norfolk	57	12	46	64	30	21	58	20	23	13	344
DELAWARE BAY	WMLG	Norfolk	32	22	91	35	21	30	0	30	36	22	319
CHESAPEAKE BAY	WMLH	Norfolk	35	24	52	45	35	21	31	37	36	21	337
NOAA SHIP ALBATROSS IV	WMVF	Norfolk	0	0	0	0	0	0	19	57	68	66	210
ADVANTAGE	WPPO	Norfolk	9	7	36	0	17	28	9	8	53	1	168
NOAA SHIP THOMAS JEFF	WTEA	Norfolk	0	0	0	0	0	0	0	0	4	3	7
NOAA SHIP NANCY FOSTER	WTER	Norfolk	0	0	0	2	17	44	49	64	29	43	248
Norfolk Ships: 45			803	571	662	742	766	573	674	825	897	889	7402

Ship Name	Call	Port	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	TOTAL
CARNIVAL CONQUEST	3FPQ9	New Orleans	0	1	5	12	10	8	9	5	9	14	73
DISCOVERER ENTERPRISE	3FZQ7	New Orleans	13	3	2	2	0	0	16	23	21	16	96
ZIM ITALIA	4XGT	New Orleans	38	0	13	36	0	0	1	12	0	0	100
ZIM ISRAEL	4XGX	New Orleans	3	2	13	/1	55	23	52	12	0	0	231
MT VIRGO VOYAGER	C6FG8	New Orleans	53	15	17	53	37	17	11	5	16	13	237
CHARLES B. RENFREW	C6JP	New Orleans	0	0	0	0	32	17	10	0	0	0	59
BERNARDO QUINTANA A	C6KJ5	New Orleans	70	64	36	50	68	115	56	62	62	77	660
ATLANTIC FOREST	ELTN8	New Orleans	0	0	59	0	0	0	0	0	0	0	59
CELEBRATION	H3GQ	New Orleans	3	0	0	0	1	33	18	12	8	6	81
DISCOVERER DEEP SEAS	HP9685	New Orleans	20	23	15	34	35	44	56	57	46	47	377
ROGER REVELLE	KAOU	New Orleans	47	24	5	7	1	41	38	49	61	82	355
CAPT STEVEN L BENNETT	KAXO	New Orleans	92	109	100	36	46	75	0	47	55	0	560
JUDY LITRICO	KCKB	New Orleans	79	37	9	4	40	3	48	39	21	54	334
LIBERTY SEA	KPZH	New Orleans	41	0	0	41	0	0	14	21	14	15	146
LIBERTY GRACE	WADN	New Orleans	9	0	0	0	1	0	0	0	27	0	37
POLAR ENDEAVOUR	WCAJ	New Orleans	9	12	18	11	16	14	11	20	27	15	153
LIBERTY STAR	WCBP	New Orleans	58	26	68	67	66	55	13	54	0	2	409
LIBERTY SUN	WCOB	New Orleans	46	29	54	17	20	55	21	29	26	20	317
LIBERTY SPIRIT	WCPU	New Orleans	0	49	61	13	28	18	20	16	27	34	266
SHEILA MCDEVITT	WDA4069	New Orleans	0	0	55	28	3	7	0	1	0	0	94
ATLANTIC FOREST	WDB2122	New Orleans	0	0	0	0	0	0	0	0	0	31	31
M/T MONTAUK	WDCJ	New Orleans	29	10	31	16	17	35	32	53	46	33	302
POLAR RESOLUTION	WDJK	New Orleans	21	20	12	20	25	18	28	25	30	76	275
WILSON	WNPD	New Orleans	48	44	0	0	0	0	0	0	0	0	92
NOAA SHIP OREGON II	WTDO	New Orleans	101	84	0	0	121	66	82	125	105	119	803
NOAA SHIP RONALD H BROWN	WTEC	New Orleans	0	22	57	0	0	79	98	59	41	50	406
NOAAS GORDON GUNTER	WTEO	New Orleans	0	0	0	0	0	82	136	149	157	143	667
New Orleans Ships: 27			780	574	630	518	622	805	770	875	799	847	7220
ORIENTE HOPE	3ETH4	Seattle	0	0	0	0	0	0	0	0	0	2	2
CHANG JIANG BRIDGE	3EZJ9	Seattle	0	0	0	0	0	0	0	0	49	42	91
RUBIN ARTEMIS	3FAH7	Seattle	0	0	0	0	0	0	0	0	2	14	16
SEVEN SEAS	3FBS9	Seattle	0	0	0	0	0	0	0	0	8	0	8
EVER URANUS	3FCA9	Seattle	0	0	0	6	0	13	0	0	12	0	31
GOLDEN NOVA	3FDV6	Seattle	9	21	32	0	0	0	5	0	0	2	69
EVER ULTRA	3FEJ6	Seattle	0	4	0	0	0	0	0	15	0	0	19
ARIES HARMONY	3FEY7	Seattle	0	7	12	3	6	0	3	2	4	1	38
KURE	3FGN3	Seattle	7	7	22	23	23	21	7	19	18	16	163
ORIENTE GRACE	3FHT4	Seattle	0	0	0	0	0	24	42	0	0	1	67
KEN KOKU	3FMN6	Seattle	0	0	8	5	0	0	0	0	0	0	13
BRIGHT STATE	3FMY7	Seattle	30	27	34	29	43	16	42	27	33	23	304
ORIENTE PRIME	3FOU4	Seattle	21	12	1	0	0	0	0	0	0	0	34
BLUE GEMINI	3FPA6	Seattle	72	42	76	13	94	47	0	0	0	6	350
LEO FOREST	3FPH8	Seattle	0	0	1	0	0	0	0	0	0	0	1
DAISHIN MARU	3FPS6	Seattle	85	90	71	62	41	0	0	0	0	1	350
OLYMPIAN HIGHWAY	3FSH4	Seattle	1	27	65	81	95	92	98	25	0	0	484
OCEAN CAMELLIA	3FTR6	Seattle	0	0	1	0	0	0	0	0	0	0	1
ORIENTE VICTORIA	3FVG8	Seattle	29	15	0	0	0	0	0	0	0	0	44
SUPER RUBIN	3FWP5	Seattle	0	0	0	0	8	0	0	0	0	0	8
EVER UNIQUE	3FXQ6	Seattle	10	0	0	6	0	7	5	0	5	0	33
KEISHO	3FYN4	Seattle	0	0	0	0	0	0	0	8	38	2	48
APL KENNEDY	9VAY4	Seattle	0	0	0	0	53	75	34	71	64	45	342
KEE LUNG	BHFN	Seattle	50	83	34	45	2	0	0	0	0	0	214
IBIS ARROW	C6CU6	Seattle	0	0	17	23	14	29	0	0	36	28	147
CORMORANT ARROW	C6IO9	Seattle	0	0	34	46	24	57	6	27	35	25	254
WESTWOOD MARIANNE	C6QD3	Seattle	50	48	30	49	42	48	55	14	63	41	440

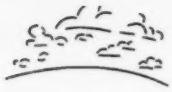
Ship Name	Call	Port	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	TOTAL
WESTWOOD ANETTE	C6QO9	Seattle	16	6	16	24	5	0	25	16	9	10	127
WESTWOOD RAINIER	C6SI3	Seattle	78	44	41	36	40	99	65	53	25	30	511
WESTWOOD COLUMBIA	C6SI4	Seattle	0	0	37	31	25	23	19	25	28	29	217
CSL CABO	D5XH	Seattle	0	12	20	33	32	21	17	8	10	13	166
EVERETT EXPRESS	DPGD	Seattle	32	32	25	30	29	24	15	11	35	46	279
PUSAN SENATOR	DQVG	Seattle	34	29	36	25	28	9	4	30	13	22	230
PENANG SENATOR	DQVH	Seattle	37	47	20	41	31	14	37	15	51	79	372
GLORIOUS SUCCESS	DUHN	Seattle	34	0	0	4	0	1	0	0	0	0	39
RUBIN KOBE	DYZM	Seattle	5	16	18	12	20	20	1	18	0	0	110
SANTA BARBARA	ELOT3	Seattle	34	42	47	43	24	37	20	30	22	43	342
GERMAN SENATOR	ELPL3	Seattle	0	0	0	1	0	0	0	0	0	0	1
WORLD SPIRIT	ELWG7	Seattle	42	34	44	45	28	29	0	1	0	0	223
UNITED SPIRIT	ELYB2	Seattle	34	32	31	46	37	53	14	29	47	63	386
ORIENTE SHINE	H9AL	Seattle	17	15	13	0	0	0	0	0	0	0	45
WESTWOOD JAGO	H9IL	Seattle	14	20	0	0	2	0	0	0	0	0	36
WESTWARD VENTURE	KHJB	Seattle	0	19	27	55	57	50	42	95	31	1	377
NORTH STAR	KIYI	Seattle	0	0	0	0	0	0	0	0	32	34	66
THOMAS G. THOMPSON	KTDQ	Seattle	0	6	33	46	52	82	41	26	14	6	306
SKAUGRAN	LADB2	Seattle	31	46	52	73	43	37	23	14	0	0	319
STAR DOVER	LAEP4	Seattle	36	30	0	38	0	0	0	0	0	1	105
WESTWOOD BORG	LAON4	Seattle	82	43	85	48	68	44	65	48	44	72	599
WESTWOOD BREEZE	LAOT4	Seattle	47	63	43	44	53	71	43	24	31	66	485
P&O NEDLLOYD MARSEILLE	MYSU5	Seattle	23	2	9	17	20	27	4	0	0	0	102
USCGC POLAR STAR WAGB 1	NBTM	Seattle	0	0	0	0	0	0	0	1	1	0	2
USCGC HEALY WAGB-20	NEPP	Seattle	123	54	83	3	0	45	60	53	83	56	560
USCGC POLAR SEA WAGB 11	NRUO	Seattle	83	86	252	78	0	0	0	0	0	18	517
COLUMBINE MAERSK	OUHC2	Seattle	4	38	1	0	0	0	0	54	0	1	98
CLEMENTINE MAERSK	OUQK2	Seattle	0	0	0	1	0	19	7	0	22	5	54
A.P. MOLLER	OVYQ2	Seattle	0	31	20	0	17	21	0	23	20	0	132
CHARLOTTE MAERSK	OWLD2	Seattle	0	42	20	0	15	19	0	29	19	0	144
CORNELIA MAERSK	OWWS2	Seattle	0	0	0	0	0	40	24	0	24	17	105
SOVEREIGN MAERSK	OYGA2	Seattle	0	11	48	0	3	23	0	0	0	33	118
SVEND MAERSK	OYJS2	Seattle	19	20	0	29	13	18	38	25	0	26	188
SOROE MAERSK	OYKJ2	Seattle	31	13	0	25	36	0	38	28	0	26	197
SALLY MAERSK	OZHS2	Seattle	0	0	0	0	0	0	65	0	0	56	121
SINE MAERSK	OZOK2	Seattle	36	1	0	24	0	0	0	35	0	0	96
MAERSK SVENDBORG	OZSK2	Seattle	34	42	0	0	40	0	0	19	37	2	174
CARSTEN MAERSK	OZYB2	Seattle	51	0	0	0	0	0	0	0	0	0	51
CHASTINE MAERSK	OZZB2	Seattle	0	0	33	4	0	66	0	0	52	1	156
HANJIN KAOHSIUNG	P3BN8	Seattle	0	0	0	0	0	0	0	25	18	18	61
NORDMAX	P3YS5	Seattle	77	58	46	55	94	57	88	15	74	65	629
MAERSK SEA	S6CW	Seattle	0	58	3	36	37	0	0	0	0	2	136
APL CHINA	S6TA	Seattle	4	60	58	0	0	0	0	0	0	0	122
APL JAPAN	S6TS	Seattle	38	43	51	68	52	49	66	63	85	61	576
KAPITAN KONEV	UAHV	Seattle	0	0	1	8	7	5	7	0	16	0	44
KAPITAN MASLOV	UBRO	Seattle	0	7	5	0	0	0	0	0	0	0	12
VLADIVOSTOK	UBXP	Seattle	71	56	63	48	41	44	51	52	36	62	524
KAPITAN AFANASYEV	UFIL	Seattle	16	10	6	19	8	0	0	0	0	0	59
TYCOM RELIANCE	V7CZ2	Seattle	0	0	0	27	30	0	0	0	0	1	58
HATSU ETHIC	VQFS4	Seattle	0	0	15	15	10	24	20	16	22	24	146
OOCL CALIFORNIA	VRWC8	Seattle	50	42	53	51	73	47	39	52	39	52	498
ISLA DE CEDROS	VRXU2	Seattle	113	54	82	72	50	109	67	105	38	37	727
HATSU ENVOY	VSQL9	Seattle	67	51	72	67	55	47	60	59	44	51	573
HATSU EXCEL	VSXV3	Seattle	48	51	46	11	15	42	24	19	18	17	291
MAHARASHTRA	VTSQ	Seattle	0	0	0	0	0	0	0	0	0	12	12
MIDNIGHT SUN	WAHG	Seattle	0	0	0	0	28	53	45	30	19	39	214
NATHANIEL B. PALMER	WBP3210	Seattle	13	0	0	0	0	18	73	81	45	12	242

Ship Name	Call	Port	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	TOTAL
COASTAL MERCHANT	WCV8696	Seattle	10	0	4	10	9	0	0	21	0	4	58
GREAT LAND	WFDP	Seattle	121	146	154	70	138	151	125	179	1	15	1100
PRESIDENT TRUMAN	WNDP	Seattle	37	47	66	70	29	32	46	55	40	10	432
PRESIDENT JACKSON	WRYC	Seattle	58	68	65	57	59	68	55	61	47	52	590
PRESIDENT POLK	WRYD	Seattle	32	70	57	45	28	63	139	89	63	43	629
PRESIDENT ADAMS	WRYW	Seattle	65	62	74	35	66	88	65	56	74	64	649
WECOMA	WSD7079	Seattle	59	69	38	61	97	80	61	69	79	18	631
NOAA SHIP MILLER FREEMAN	WTDM	Seattle	0	129	165	6	156	157	157	40	114	40	964
NOAA SHIP RAINIER	WTEF	Seattle	1	0	0	0	0	1	25	2	0	1	30
NOAA SHIP MCARTHUR II	WTEJ	Seattle	0	0	0	0	0	2	134	185	171	159	651
RUBIN PEARL	YJQA8	Seattle	0	0	0	0	0	0	0	19	0	21	40
HATSU EAGLE	ZNZH6	Seattle	0	0	0	7	7	3	21	10	5	11	64
Seattle Ships: 96			2221	2340	2616	2085	2252	2461	2332	2221	2065	1896	22489
EVER ROYAL	3FGI3	Long Beach	0	0	0	0	6	1	0	0	0	0	7
EVER ROUND	3FQN3	Long Beach	10	0	0	0	0	0	0	0	0	0	10
TAI HE	BOAB	Long Beach	35	9	0	0	0	0	0	0	0	0	44
JUBILEE	C6FM7	Long Beach	8	11	13	13	11	0	0	0	0	0	56
TOWER BRIDGE	ELJL3	Long Beach	0	1	1	0	0	0	0	0	0	0	2
CALIFORNIA JUPITER	ELKU8	Long Beach	23	38	7	0	0	0	0	0	0	0	68
CSAV BUSAN	ELWZ3	Long Beach	55	35	53	31	52	25	57	60	0	0	368
P&O NEDLLOYD YANTIAN	ELYD5	Long Beach	28	0	0	0	18	21	45	57	62	68	299
SEALAND EXPRESS	KGJD	Long Beach	0	0	0	0	0	0	32	25	0	0	57
SEALAND ENDURANCE	KGJX	Long Beach	29	62	0	0	0	0	0	0	0	0	91
SEALAND VOYAGER	KHRK	Long Beach	13	55	62	49	47	72	82	55	80	64	579
PRUDHOE BAY	KPFD	Long Beach	1	0	0	0	0	0	0	0	0	0	1
STAR GRAN	LADR4	Long Beach	23	6	6	0	0	15	37	10	37	29	163
TAMPA	LMWO3	Long Beach	34	4	0	0	0	0	0	0	0	0	38
MATHILDE MAERSK	OUUU2	Long Beach	16	13	8	3	24	28	10	25	25	30	182
MARCHEN MAERSK	OWDQ2	Long Beach	29	24	27	13	32	21	0	0	0	0	146
MAREN MAERSK	OWZU2	Long Beach	22	31	26	29	18	14	19	28	22	15	224
METTE MAERSK	OXKT2	Long Beach	29	26	25	25	50	55	53	50	36	43	392
DIRCH MAERSK	OXQP2	Long Beach	66	21	139	24	23	39	22	38	12	40	424
MARGRETHE MAERSK	OYSN2	Long Beach	31	35	28	8	20	9	39	17	28	8	223
TAUSALA SAMOA	V2FA2	Long Beach	0	0	1	1	0	0	0	0	0	0	2
MAERSK DUBLIN	V2PW3	Long Beach	18	26	22	24	21	20	2	0	0	0	133
SEALAND METEOR	V7AP7	Long Beach	75	49	60	51	40	55	39	27	16	4	416
SEALAND RACER	V7AP8	Long Beach	25	14	26	32	33	28	9	14	0	0	181
SEALAND CHARGER	V7AY2	Long Beach	16	2	11	1	30	54	27	59	0	0	200
SEALAND EAGLE	V7AZ8	Long Beach	23	16	18	7	40	13	21	10	1	1	150
OOCL NETHERLANDS	VRVN6	Long Beach	27	27	22	50	29	16	26	21	2	0	220
OOCL FAIR	VRWB8	Long Beach	51	61	52	19	50	46	49	47	52	58	485
OOCL FRIENDSHIP	VRWD3	Long Beach	50	56	49	17	43	0	0	0	0	0	215
OOCL FIDELITY	VRWG5	Long Beach	38	19	30	35	24	0	1	2	13	0	162
HORIZON CONSUMER	WCHF	Long Beach	50	40	9	24	16	4	21	28	30	31	253
APL SINGAPORE	WCX8812	Long Beach	57	62	64	68	63	49	51	67	54	42	577
APL THAILAND	WCX8882	Long Beach	62	47	60	21	30	43	38	37	29	32	399
APL KOREA	WCX8883	Long Beach	31	43	46	37	23	25	26	37	46	58	372
APL PHILIPPINES	WCX8884	Long Beach	28	32	29	25	46	37	23	67	54	42	383
PRESIDENT GRANT	WCY2098	Long Beach	66	50	68	1	59	50	57	50	52	53	506
PRESIDENT WILSON	WCY3438	Long Beach	36	20	21	42	43	54	46	37	6	38	343
APL CHINA	WDB3161	Long Beach	0	0	0	29	33	52	57	46	38	44	299
MELVILLE	WECB	Long Beach	90	65	64	95	57	71	39	24	4	13	522
EWA	WEZM	Long Beach	10	27	43	34	16	22	35	20	17	43	267
HORIZON RELIANCE	WFLH	Long Beach	81	83	72	69	92	90	81	91	81	96	836
SEALAND INDEPENDENCE	WGJC	Long Beach	1	0	14	0	0	0	0	0	0	0	15

Ship Name	Call	Port	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	TOTAL
SEALAND EXPLORER	WGJF	Long Beach	63	51	44	58	59	46	48	57	0	0	426
NEW HORIZON	WKWB	Long Beach	0	48	30	0	0	13	31	49	62	52	285
POLAR CALIFORNIA	WMCV	Long Beach	39	25	41	15	18	3	14	5	0	1	161
HORIZON NAVIGATOR	WPGK	Long Beach	63	57	47	51	43	53	68	61	38	50	531
R.J. PFEIFFER	WRJP	Long Beach	27	22	28	26	34	26	22	19	15	21	240
MAUI	WSLH	Long Beach	40	35	32	47	49	25	36	52	39	48	403
KAUAI	WSRH	Long Beach	61	55	61	58	59	45	66	47	40	15	507
HORIZON PACIFIC	WSRL	Long Beach	54	30	44	55	62	68	70	72	73	62	590
DENALI	WSVR	Long Beach	36	22	15	17	29	8	25	22	13	21	208
NOAA DAVID STARR JORDAN	WTDK	Long Beach	0	2	0	0	0	0	0	0	18	0	20
Long Beach Ships: 52			1670	1457	1518	1204	1442	1316	1424	1433	1095	1122	13681
EASTERN EXPRESS	3FDN7	Houston	0	0	0	0	18	71	48	38	30	31	236
DEEPWATER MILLENNIUM	3FJA9	Houston	27	16	14	15	16	21	1	0	0	0	110
ENIF	9VVI	Houston	18	0	0	0	0	0	0	0	0	0	18
AMERICA STAR	GZKA	Houston	0	0	68	0	0	0	0	0	0	0	68
DEEPWATER HORIZON	H3SM	Houston	0	0	0	0	0	0	0	18	46	51	115
SARGASSO	H9YR	Houston	0	0	0	0	0	0	0	3	0	0	3
SAUDI DIRIYAH	HZZB	Houston	0	0	30	44	14	120	6	54	27	49	344
SAUDI HOFUF	HZZC	Houston	25	22	50	37	39	14	39	46	1	63	336
SAUDI TABUK	HZZD	Houston	0	0	0	0	1	0	0	71	23	38	133
CAPE VINCENT	KAES	Houston	0	0	0	3	37	0	0	0	0	1	41
CHEMICAL PIONEER	KAFO	Houston	21	39	34	26	30	12	12	0	0	0	174
ROVER	KCBH	Houston	18	6	0	19	18	45	35	29	38	9	217
COURIER	KCBK	Houston	5	49	0	0	6	3	42	59	9	4	177
GUS W. DARNELL	KCDK	Houston	27	0	15	0	0	0	30	23	3	1	99
CLEVELAND	KGXA	Houston	17	38	37	30	56	59	61	61	51	42	452
SEALAND DEVELOPER	KHRH	Houston	63	64	58	22	28	70	91	53	37	27	513
MARINE CHEMIST	KMCB	Houston	5	0	0	0	0	0	0	0	0	0	5
CHEMICAL EXPLORER	KRGC	Houston	0	1	0	0	0	0	0	0	0	0	1
SEALAND FLORIDA	KRHX	Houston	37	51	73	28	0	40	65	83	45	53	475
LIBERTY WAVE	KRHZ	Houston	0	12	1	0	0	0	28	0	0	18	59
SEALAND ATLANTIC	KRLZ	Houston	35	50	39	51	34	70	52	11	0	31	373
SEALAND QUALITY	KRNJ	Houston	60	42	69	47	23	27	9	49	31	25	382
SEALAND COMMITMENT	KRPB	Houston	88	55	76	63	69	127	156	64	55	3	756
SEALAND PERFORMANCE	KRPD	Houston	38	46	45	52	62	68	43	26	29	36	445
NOBEL STAR	KRPP	Houston	32	36	32	17	25	0	0	10	19	17	188
CYNTHIA FAGAN	KSDF	Houston	41	31	1	0	0	47	7	27	59	12	225
TEXAS CLIPPER II	KVWA	Houston	0	0	0	0	4	13	16	1	0	1	35
STAR ISTIND	LAMP5	Houston	51	43	37	33	51	57	26	29	0	0	327
STAR FLORIDA	LAVW4	Houston	61	14	38	39	9	18	29	11	21	25	265
STAR FRASER	LAVY4	Houston	5	0	4	38	0	20	19	53	0	0	139
RHAPSODY OF THE SEAS	LAZK4	Houston	0	0	0	0	0	22	43	23	3	3	94
QUEENSLAND STAR	MZBM7	Houston	79	15	0	0	0	0	0	0	0	0	94
PAUL BUCK	NBBO	Houston	0	0	0	0	0	0	12	0	0	0	12
USNS MARY SEARS T-AGS 6	NRFR	Houston	0	0	0	0	0	38	36	56	61	35	226
PACIFIC EXPLORER	V7DN3	Houston	0	0	42	87	93	56	64	55	0	31	428
NUEVO LEON	VQHV6	Houston	0	0	0	0	0	0	16	33	4	0	53
LYKES CHALLENGER	VSRL8	Houston	0	0	0	0	51	18	8	0	10	11	98
LYKES AMBASSADOR	VSRL9	Houston	21	10	9	12	9	6	8	10	13	4	102
TMM TABASCO	VSUA5	Houston	5	4	0	0	0	0	0	0	0	0	9
TMM CAMPECHE	VSXC9	Houston	35	30	17	16	14	26	22	10	4	16	190
SEALAND MOTIVATOR	WAAH	Houston	85	67	22	68	50	81	54	112	75	53	667
LYKES MOTIVATOR	WABU	Houston	31	38	49	34	20	39	57	53	42	19	382
SEALAND PRIDE	WDA3673	Houston	56	51	66	63	60	71	113	98	81	51	710
OVERSEAS NEW ORLEANS	WFKW	Houston	26	32	46	33	29	39	42	37	35	34	353
OVERSEAS MARILYN	WFQB	Houston	0	0	0	0	0	0	0	0	7	13	20
OVERSEAS PHILADELPHIA	WGDB	Houston	0	0	0	0	0	0	0	3	4	3	10

Ship Name	Call	Port	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	TOTAL
LYKES EXPLORER	WGLA	Houston	47	24	72	62	38	62	42	104	55	38	544
LYKES NAVIGATOR	WGMJ	Houston	48	50	23	41	49	95	106	76	40	63	591
LYKES LIBERATOR	WGXN	Houston	33	57	48	35	61	74	42	97	60	56	563
LYKES DISCOVERER	WGXO	Houston	165	102	165	147	126	121	213	234	167	64	1504
SAG RIVER	WLDF	Houston	7	0	0	0	0	0	0	0	0	0	7
MORMACSUN	WMBK	Houston	0	11	40	50	12	0	0	0	0	0	113
SEALAND ACHIEVER	WPKD	Houston	43	39	56	25	34	32	87	58	69	47	490
SEALAND INTEGRITY	WPVD	Houston	136	83	125	160	142	52	60	154	146	129	1187
OVERSEAS HARRIETTE	WRFJ	Houston	45	36	6	18	16	13	34	46	44	19	277
MAERSK CONSTELLATION	WRYJ	Houston	28	10	0	0	0	0	21	33	5	20	117
CAPE TEXAS	WSDG	Houston	0	0	4	3	0	0	0	0	0	1	8
BUFFALO SOLDIER	WWXB	Houston	9	24	4	0	0	0	0	0	0	0	37
SKANDERBORG	ZCIG4	Houston	0	0	0	0	0	0	0	38	39	35	112
LYKES RANGER	ZIYE7	Houston	0	0	0	0	30	55	49	56	42	36	268
Houston Ships: 60			1573	1298	1515	1418	1374	1802	1944	2205	1530	1318	15977
POLAR TEXAS	KNFD	Valdez	19	14	23	10	15	18	14	6	11	16	146
POLAR ALASKA	KSBK	Valdez	8	13	9	10	11	8	0	11	6	8	84
GUARD	WCY2823	Valdez	0	0	0	0	0	0	0	1	0	0	1
SEARIVER GALENA BAY	WGZK	Valdez	0	0	0	0	1	2	0	0	0	0	3
Valdez Ships: 4			27	27	32	20	27	28	14	18	17	24	234
AQUARIUS ACE	3FHB8	NYC	50	48	32	62	41	51	45	57	0	0	386
EVER DEVELOP	3FLF8	NYC	0	0	0	3	2	0	4	0	0	0	9
EVER DIADEM	3FOF8	NYC	10	7	9	5	0	0	0	0	0	0	31
EVER REACH	3FQO4	NYC	53	12	38	14	31	0	19	0	0	17	184
EVER DYNAMIC	3FUB8	NYC	6	4	8	0	0	0	0	0	0	0	18
ZIM ASIA	4XFB	NYC	25	23	30	35	13	17	60	44	0	0	247
ZIM AMERICA	4XGR	NYC	48	0	0	15	4	2	46	1	0	0	116
EVER GOODS	BKHZ	NYC	12	8	2	0	0	0	0	0	0	0	22
ALBEMARLE ISLAND	C6LU3	NYC	69	70	148	77	58	32	61	48	49	36	648
PINE ARROW	C6NZ3	NYC	34	34	43	39	12	43	14	36	0	0	255
ARCTIC OCEAN	C6T2062	NYC	0	0	1	0	0	0	0	0	1	0	2
INDIAN OCEAN	C6T2063	NYC	18	20	21	13	29	52	28	18	31	34	264
ATLANTIC OCEAN	C6T2064	NYC	60	79	59	57	37	27	45	28	43	23	458
ARGONAUT	KFDV	NYC	18	2	1	0	0	0	0	22	0	0	43
HORIZON HAWAII	KIRF	NYC	34	61	64	70	71	69	57	61	112	79	678
EMPIRE STATE	KKFW	NYC	31	8	0	0	22	14	24	0	0	0	99
ITB GROTON	KMJL	NYC	40	27	15	21	28	52	33	27	42	45	330
NOAA SHIP DELAWARE II	KNBD	NYC	70	91	117	115	95	0	139	143	110	6	886
MAJESTIC MAERSK	OUJH2	NYC	18	21	20	47	7	27	19	26	38	22	245
MARIE MAERSK	OULL2	NYC	24	13	46	24	33	43	0	57	0	51	291
MUNKEBO MAERSK	OUNI5	NYC	19	12	31	19	19	23	8	37	0	1	169
MAGLEBY MAERSK	OUSH2	NYC	0	7	13	20	6	22	2	42	15	1	128
MC-KINNEY MAERSK	OUZW2	NYC	5	17	0	0	0	0	0	0	0	0	22
JOHANNES MAERSK	OWFD2	NYC	0	0	0	0	0	0	0	0	77	15	92
KNUD MAERSK	OYBJ2	NYC	0	0	58	1	0	0	0	0	0	1	60
ENDURANCE	WAUU	NYC	40	27	29	40	31	29	39	59	32	19	345
ENDEAVOR	WAUW	NYC	34	31	55	1	55	38	52	27	33	48	374
ENTERPRISE	WAUY	NYC	15	0	27	0	0	129	4	23	42	50	290
MAERSK CAROLINA	WBDS	NYC	0	0	0	0	40	3	11	11	45	43	153
GREEN POINT	WCY4148	NYC	54	42	33	30	38	11	53	8	13	9	291
HORIZON PRODUCER	WJBJ	NYC	70	69	83	80	76	67	73	67	53	61	699
1ST LT JACK LUMMUS	WJLV	NYC	3	0	0	0	0	0	0	0	0	0	3
MAURICE EWING	WLDZ	NYC	0	0	0	50	42	70	49	57	39	56	363
MANUKAI	WRGD	NYC	0	0	0	0	0	0	0	0	0	9	9
New York City Ships: 33			860	733	983	838	790	821	885	899	775	626	8210

Total Ships: 624	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**TOTAL**
	12644	10983	13430	11937	13025	14127	15234	15136	13427	12847	132790



Meteorological Services

U.S. Port Meteorological Officers

Headquarters

David McShane
Voluntary Observing Ship Technical Leader
National Data Buoy Center
Building 1100, Room 353A
Stennis Space Center, MS 39529-6000
Tel: 228-688-1768
Fax: 228-688-3153
E-mail:david.mcshane@noaa.gov

Robert A. Luke
Voluntary Observing Ship Program Leader
National Data Buoy Center
Building Bldg. 3203, Room 305B
Stennis Space Center, MS 39529-6000
Tel: 228-688-1457
Fax: 228-688-3923
E-mail: robert.luke@noaa.gov

Atlantic Ports

Robert Drummond, PMO
National Weather Service, NOAA
2550 Eisenhower Blvd, Suite 312
P.O. Box 165504
Port Everglades, FL 33316
Tel: 954-463-4271
Fax: 954-462-8963
E-mail: robert.drummond@noaa.gov

Lawrence Cain, PMO
National Weather Service, NOAA
13701 Fang Road
Jacksonville, FL 32218-7933
Tel: 904-741-5186
Fax: 904-741-0078
E-mail: larry.cain@noaa.gov

Tim Kenfick, PMO Charleston
NOAA Coastal Services Center
2234 South Hobson Avenue
Charleston, SC 29405-2413
Tel: 843-740-1281
Fax: 843-740-1289
E-mail: timothy.kenefick@noaa.gov

Peter Gibino, PMO, Norfolk
National Weather Service, NOAA
4034-B G. Washington Highway
Yorktown, VA 23692-2724
Tel: 757-877-1692
Fax: 757-877-9561
E-mail: peter.gibino@noaa.gov

James Saunders, PMO
National Weather Service, NOAA
Maritime Center I, Suite 287
2200 Broening Highway
Baltimore, MD 21224-6623
Tel: 410-633-4709
Fax: 410-633-4713
E-mail: james.saunders@noaa.gov

Jim Luciani, PMO
New York/New Jersey
National Weather Service, NOAA
110 Lower Main Street, Suite 201
South Amboy, NJ 08879-1367
Tel: 732-316-5409
Fax: 732-316-7643

Great Lakes Ports

Amy Seeley, PMO
National Weather Service, NOAA
333 West University Dr.
Romeoville, IL 60446-1804
Tel: 815-834-0600 Ext. 269
Fax: 815-834-0645
E-mail: amy.seeley@noaa.gov

Gulf of Mexico Ports

John Warrelmann, PMO
National Weather Service, NOAA
Louis Armstrong International Airport
Box 20026
New Orleans, LA 70141
Tel: 504-589-4839
E-mail: john.warrelmann@noaa.gov

Chris Fakes, PMO
National Weather Service, NOAA
Houston Area Weather Office
1620 Gill Road
Dickinson, TX 77539-3409
Tel: 281-534-2640 Ext. 277
Fax: 281-337-3798
E-mail: chris.fakes@noaa.gov

Pacific Ports

Derek LeeLoy
Ocean Services Program Coordinator
National Weather Service Pacific Region HQ
Grosvenor Center, Mauka Tower
737 Bishop Street, Suite 2200
Honolulu, HI 96813-3201
Tel: 808-532-6439
Fax: 808-532-5569
E-mail: derek.leeloy@noaa.gov

Robert Webster, PMO
National Weather Service, NOAA
501 West Ocean Blvd., Room 4480
Long Beach, CA 90802-4213
Tel: 562-980-4090
Fax: 562-980-4089
E-mail: bob.webster@noaa.gov

Robert Novak, PMO
National Weather Service, NOAA
1301 Clay Street, Suite 1190N
Oakland, CA 94612-5217
Tel: 510-637-2960
Fax: 510-637-2961
E-mail: bob.novak@noaa.gov

Patrick Brandow, PMO
National Weather Service, NOAA
7600 Sand Point Way, N.E.
BIN C15700
Seattle, WA 98115-6349
Tel: 206-526-6100
Fax: 206-526-4571 or 6094
E-mail: pat.brandow@noaa.gov

Richard Courtney
National Weather Service, NOAA
600 Sandy Hook Street, Suite 1
Kodiak, AK 99615-6814
Tel: 907-487-2102
Fax: 907-487-9730
E-mail: richard.courtney@noaa.gov

Debra Russell, OIC
National Weather Service, NOAA
Box 427
Valdez, AK 99686-0427
Tel: 907-835-4505
Fax: 907-835-4598
E-mail: debra.russell@noaa.gov

Larry Hubble
National Weather Service Alaska Region
222 West 7th Avenue #23
Anchorage, AK 99513-7575
Tel: 907-271-5135
Fax: 907-271-3711
E-mail: larry.hubble@noaa.gov

SEAS Field Representatives

GOOS Center Manager
Steve Cook
8604 La Jolla Shores Drive
La Jolla, CA 92037-1508
Tel: 858-546-7103
Fax: 619-546-7185
E-mail: steven.cook@noaa.gov

Northeast Atlantic SEAS Rep.
Jim Farrington
SEAS Logistics/AMC
439 West York Street
Norfolk, VA 23510
Tel: 757-441-3062
Fax: 757-441-6495
E-mail: james.w.farrington@noaa.gov

Pacific Northwest SEAS Rep.
Steve Noah
SEAS Logistics/PMC
Olympic Computer Services, Inc.
Tel: 360-385-2400
Cell: 425-238-6501
E-mail: snoah@olycomp.com
or KARSTENO@aol.com

Southwest Pacific SEAS Rep.
Carrie Wolfe
Southern California Marine Institute
820 S. Seaside Avenue
San Pedro, Ca 90731-7330
Tel: 310-519-3181
Fax: 310-519-1054
E-mail: hbbio048@csun.edu

Southeast Atlantic SEAS Rep.
Ann-Marie Wilburn
AOML/GOSO Center
4301 Rickenbacker Causeway
Miami, FL 33149-1026
Tel: 305-361-4336
Fax: 305-361-4366
E-mail: wilburn@aoml.noaa.gov

Global Drifter Program
Craig Engler
AOML/PHOD
4301 Rickenbacker Causeway
Miami, FL 33149-1026
Tel: 305-361-4439
Fax: 305-361-4366
E-mail: craig.engler@noaa.gov

NIMA Fleet Liaisons

Adam Veracka, Fleet Liaison Branch Head
QMCM Randy Bryant, Fleet Liaison Coordinator
ATTN: Mail Stop D-44
4600 Sangamore Road
Bethesda, MD 20816-5003
Tel: 301-227-3173/3146
Fax: 301-227-4211
E-mail: veracka@nima.mil
bryantral@nima.mil

U.S. Coast Guard AMVER Center

Richard T. Kenney
AMVER Maritime Relations Officer
United States Coast Guard
Battery Park Building
New York, NY 10004
Tel: 212-668-7764
Fax: 212-668-7684
E-mail: rkenney@batteryny.uscg.mil

Other Port Meteorological Officers

Australia

Head Office
Marine Observations Unit
Bureau of Meteorology
150 Lonsdale Street, 7th Floor
Melbourne, VIC 3000
Tel: +613 9669 4651
Fax: +613 9669 4168
E-mail: marine_obs@bom.gov.au

Melbourne
Michael J. Hills, Port Meteorological Agent
Victoria Regional Office
Bureau of Meteorology
150 Lonsdale Street, 26th Floor
Melbourne, VIC 3000
Tel: +613 9669 4982
Fax: +613 9663 4957
E-mail: m.hills@bom.gov.au

Fremantle
Malcolm Young, Port Meteorological Agent
MalMet Services Pty Ltd
Unit 3/76 Gardner Street
COMO WA 6152
Tel: +618 9474 1974
Fax: +618 9260 8475
E-mail: malyoung@iinet.net.au

Sydney
Captain Einion E. (Taffy) Rowlands, PMA
NSW Regional Office
Bureau of Meteorology, Level 15
300 Elizabeth Street
Sydney NSW 2000
Tel:+612 9296 1547
Fax: +612 9296 1648
E-mail: e.rowlands@bom.gov.au

Canada

Nova Scotia
Randy Sheppard, PMO
Meteorological Service of Canada
16th Floor, 45 Aldernay Drive
Dartmouth, Nova Scotia B2Y 2N6
Tel: 902-426-6703
E-mail: randy.sheppard@ec.gc.ca

Newfoundland
Jack Cossar, PMO
Meteorological Service of Canada
6 Bruce Street
St. John's, Newfoundland A1N 4T3
Tel: 709-722-4798
Fax: 709-722-5097
E-mail: jack.cossar@ec.gc.ca

British Columbia
Michael Riley, PMO
Meteorological Service of Canada
700-1200 West 73rd Avenue
Vancouver, British Columbia V6P 6H9
Tel: 604-664-9136
Fax: 604-664-9195
E-mail: mike.riley@ec.gc.ca

Ontario
Rən Fordyce, Supt. Marine Data Unit
Rick Shukster, PMO
Roland Kleer, PMO
Meteorological Service of Canada
Port Meteorological Office
100 East Port Blvd.
Hamilton, Ontario L8H 7S4
Tel: 905-312-0900
Fax: 905-312-0730
E-mail: ron.fordyce@ec.gc.ca
rick.shukster@ec.gc.ca
roland.kleer@ec.gc.ca

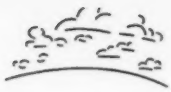
Quebec
Eric Gola, PMO
Meteorological Service of Canada-Quebec Region
100 Alexis Nihon, Suite 300, 3rd Floor
Montreal, Quebec H4M 2N8
Tel: 514-283-1644
514-386-8269
Fax: 514-496-1867
E-mail: erich.gola@ec.gc.ca

China

YU Zhaoguo
Shanghai Meteorological Bureau
166 Puxi Road
Shanghai, China

Denmark

Commander Lutz O. R. Niegsch
PMO, Danish Meteorological Inst.
Lyngbyvej 100, DK-2100
Copenhagen, Denmark
Tel: +45 39157500
Fax: +45 39157300



United Kingdom

Headquarters
Sarah North, Nautical Officer
Marine Observations Manager, Met. Office
Observations Supply - Marine Networks
Fitzroy Road
Exeter
Devon, EX1 3PD
Tel: +44 (0) 870 900 0100
Fax: +44 (0) 870 900 5050
Email: edward.osullivan@metoffice.com

Bristol Channel
Captain A Maytham MM, FRMetS, PGCE
Met Office
Port Met Officer - Bristol Channel
Titan House, Rm 107
Cardiff Bay Business Center
Lewis Road
Cadriff. CF24 5BS
Tel: +44 (0) 29 2045 1323
Fax:+44 (0) 29 2045 1326
E-mail: austin.maytham@metoffice.com

East England
Captain John Steel, PMO
Customs Building, Albert Dock
Hull HU1 2DP
Tel: +44 01482 320158
Fax: +44 01482 328957

Northeast England
Captain Gordon Young, PMO
Able House, Billingham Reach Ind. Estate
Billingham, Cleveland TS23 lPX
Tel: +44 0642 560993
Fax:+44 0642 562170

Northwest England
Colin B. Attfield, PMO
Room 331, Royal Liver Building
Liverpool L3 1JH
Tel:+44 0151 236 6565
Fax: +44 0151 227 4762

Scotland and Northern Ireland
Captain Peter J. Barratt, PMO
Navy Buildings, Eldon Street
Greenock, Strathclyde PA16 7SL
Tel: +44 01475 724700
Fax: +44 01475 892879

Southeast England
Captain Harry H. Gale, PMO
Trident House, 21 Berth, Tilbury Dock
Tilbury, Essex RM18 7HL
Tel: +44 01385 859970
Fax: +44 01375 859972

Southwest England
Captain James M. Roe, PMO
8 Viceroy House, Mountbatten Business Centre
Millbrook Road East
Southampton SO15 lHY
Tel: +44 023 8022 0632
Fax: +44 023 8033 7341

France

Le Havre
Yann Prigent, PMO
Station Mét., Noveau Semaphore
Quai des Abeilles, Le Havre
Tel: +33 35422106
Fax: +33 35413119

Marseille
P. Coulon
Station Météorologique
de Marseille-Port
12 rue Sainte Cassien
13002 Marseille
Tel: +33 91914651 Ext. 336

Germany

Hamburg
Volker Weidner, PMO
Deutscher Wetterdienst
Met. Hafendienst
Postfach 70 04 21
22004 Hamburg
Tel: 040 3190 8826

Volker Weidner, PMO
Peter Gollnow, PMO
Horst von Bargen, PMO
Deutscher Wetterdienst
Jenfelder Allee 70a
22043 Hamburg
Tel: +49 40 66901411
Fax: +49 40 66901496
E-mail: pmo@dwd.de

Bremerhaven
Henning Hesse, PMO
Deutscher Wetterdienst
An de Neuen Schleuse
27570 Bremerhaven
Tel: +49 471 7004018
Fax: +49 471 7004017
E-mail: pmo@dwd.de

Bremen
Ulrich Ranke, PMO
Deutscher Wetterdienst
Flughafendamm 45
28199 Bremen
Tel: +49 421 5372163
Fax: +49 421 5372166
E-mail: pmo@dwd.de

Rostock
Christel Heidner, OMP
Christine Bergs, PMO
Deutscher Wetterdienst
Seestr. 15a
18119 Rostock
Tel: +49 381 5438830
Fax: +49 381 5438863
E-mail: pmo@dwd.de

Greece

George E. Kassimidis, PMO
Port Office, Piraeus
Tel: +301 921116
Fax: +3019628952

Hong Kong

C. F. Wong, PMO
Hong Kong Observatory
134A Nathan Road
Kowloon, Hong Kong
Tel: +852 2926 3113
Fax: +852 2311 9448
E-mail: hkopmo@hko.gov.hk

Israel

Haifa
Hani Arbel, PMO
Haifa Port
Tel: 972 4 8664427

Ashdod
Aharon Ofir, PMO
Marine Department
Ashdod Port
Tel: 972 8 8524956

Japan

Headquarters
Kanno Yoshiaki
Marine Div., Climate and Marine Dept.
Japan Meteorological Agency
1-3-4 Otemachi, Chiyoda-ku
Tokyo, 100-8122 Japan
Fax: +03-3211-6908
Email: ykanno@met.kishou.go.jp

Kobe
Utsunomiya Tadayoshi, PMO
Kobe Marine Observatory
1-4-3, Wakinohamakaigan-Dori, Chuo-ku Kobe,
651-0073 Japan
Fax: +078-222-8946

Nagoya
Yazawa Yasushi, PMO
Nagoya Local Meteorological Observatory
2-18, Hiyoricho, Chigusa-ku
Nagoya, 464-0039 Japan
Fax: +052-762-1242

Yokohama
Uwabe Willy, PMO
Yokohama Local Met. Observatory
99 Yamate-cho, Naka-ku
Yokohama, 231-0862 Japan
Fax: +045-622-3520

Kenya
Ali J. Mafimbo, PMO
PO Box 98512
Mombasa, Kenya
Tel: +254 1125685
Fax: +254 11433440

Malaysia
NG Kim Lai
Assistant Meteorological Officer
Malaysian Meteorological Service
Jalan Sultan, 46667 Petaling
Selangor, Malaysia

Mauritius
Mr. S Ragoonaden
Meteorological Services
St. Paul Road, Vacoas, Mauritius
Tel: +230 6861031
Fax: +230 6861033

Netherlands
Jan Schaap, PMO
KNMI, Afd. WM/OW
Port Meteorological Office
Postbus 201
3730 AE De Bilt, Netherlands
Tel: +3130-2206391
Fax: +3130-2210849
E-mail: jan.schaap@knmi.nl

New Zealand
Julie Fletcher, MMO
MetService New Zealand Ltd.
P.O. Box 722
Wellington, New Zealand
Tel: +644 4700789
Fax: +644 4700772

Norway
Tor Inge Mathiesen, PMO
Norwegian Meteorological Institute
Allegaten 70, N-5007
Bergen, Norway
Tel: +475 55236600
Fax: +475 55236703

Poland
Jozef Kowalewski,PMO
Institute of Meteorology and Water Mgt.
Maritime Branch
ul.Waszyngtona 42, 81-342 Gdynia Poland
Tel: +4858 6205221
Fax: +4858 6207101
E-mail: kowalews@stratus/imgw.gdynia.pl

Saudi Arabia
Mahmud Rajkhan, PMO
National Met. Environment Centre
Jeddah
Tel:+ 9662 6834444 Ext. 325

Singapore
Edmund Lee Mun San, PMO
Meteorological Service, PO Box 8
Singapore Changi Airport
Singapore 9181
Tel: +65 5457198
Fax: +65 5457192

South Africa
Headquarters
Ian T. Hunter
Manager: Maritime Services
South African Weather Service
Private Bag X097
Pretoria 0001
Tel: +27 (0) 12 367 6032
Fax: +27 (0) 12 367 6042
Weatherline: 082 162
E-mail: ian@weathersa.co.za
www.weathersa.co.za

Cape Town
C. Sydney Marais, PMO
South African Weather Service
Capt Town International Airport 7525
Tel: + 27 21 934 0836
Fax: +27 21 934 3296

Durban
Gus McKay, PMO
Meteorological Office
Durban International Airpot 4029
Tel: +27 31 408 1446
Fax: +27 31 408 1445

Sweden
Morgan Zinderland
SMHI
S-601 76 Norrköping, Sweden
Tel: 516-924-0499 (0227)

United States Government
INFORMATION

Credit card orders are welcome!

Fax your orders (202) 512-2250
Phone your orders (202) 512-1800

Order Processing Code:
***5862**

☐ **YES, please send_____subscriptions to:**
Mariners Weather Log (MWL) at $19.00 ($26.60 foreign) per year (3 issues)

The total cost of my order is $_____
Price includes regular shipping & handling and is subject to change.

For privacy protection, check the box below:
☐ **Do not make my name available to other mailers**

Check method of payment:
☐ **Check payable to: Superintendent of Documents**
☐ **GPO Deposit Account** ☐☐☐☐☐☐☐☐-☐☐☐
☐ **VISA** ☐ **MasterCard** ☐ **Discover**
☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐
☐☐☐☐ (expiration date)

Name or title (Please type or print)
Company Name Room, floor, suite
Street Address
City State Zip Code + 4
Daytime phone including area code
Purchase order number (optional)

Authorizing signature **11/03**

Mail to: Superintendent of Documents, PO Box 371954, Pittsburgh PA 15250-7954
Important: Please include this completed order form with your remittance. ***Thank you for your order!***

NOTES:

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Data Buoy Center
Building 3203, Room 305B
Stennis Space Center, MS 39529-6000
Attn: Mariners Weather Log

Address Correction Requested
OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE $300

Special
Standard Rate

In this Issue:

Ice Below 48N 8

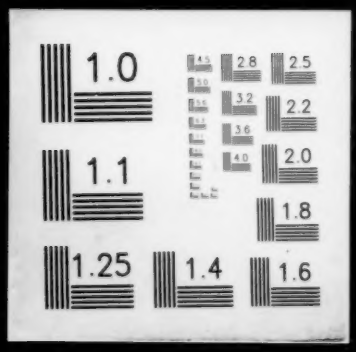
Marine Winds from Space 14

QuikSCAT and Marine Wind Warnings 20

Voyage on the Robert Seamans 27

The TransPacific 30

Obtaining Buoy Reports While At Sea 31


1.0
1.1
1.25
1.4
1.6
2.8
2.5
3.2
2.2
3.6
4.0
2.0
1.8